Vol. 7 JULY, 1913 No. 1

9

QUARTERLY

OF THE

National Fire Protection Association

Entered as second-class matter May 1, 1911, at the Post Office at Boston, Mass., under act of July 16th, 1894.

87 MILK STREET, BOSTON, MASS.

EDITED BY THE SECRETARY

National Fire Protection Association.

87 Milk Street, Boston, Mass.

Active Members.

Alabama Fire Prevention Society.
American Institute of Architects.
American Institute of Consulting Engineers.
American Institute of Electrical Engineers.
American Electric Railway Association.
American Warehousemen's Association.
Arkansas Actuarial Bureau.
Arkansas Fire Prevention Association.
Associated Factory Mutual Fire Insurance Cos. Inspection Bureau.
Association of Fire Underwriters of Baltimore City.
Board of Fire Underwriters of Allegheny County.
Board of Fire Underwriters of the Pacific.
Board of Fire Underwriters of the Territory of Hawaii.
Boston Board of Fire Underwriters.
Buffalo Association of Fire Underwriters.
Bureau for Safe Transportation of Explosives.
Canadian Fire Underwriters' Association.
Canadian Manufacturers Association.
Chicago Board of Underwriters of Chicago.
Cincinnati Fire Prevention Bureau.
Cleveland Inspection Bureau.
Cotton Insurance Association.
Electrical Supply Jobbers Association.
Factory Insurance Association.
Factory Mutual Laboratories.
Fire Underwriters' Electrical Bureau.
Fire Underwriters' Inspection Bureau.
Florida Fire Prevention Society.
Illinois Inspection Bureau.
Illinois State Fire Prevention Association.
Independent Petroleum Marketers' Association.
Indiana Inspection Bureau.
Insurance Association of Providence.
Inter-Mountain Fire Prevention Association.
International Acetylene Association.
International Association of Fire Engineers.
International Association of Municipal Electricians.
Iowa State Fire Prevention Association.
Kansas Inspection and Fire Prevention Office.
Kentucky Actuarial Bureau.
Kentucky State Fire Prevention Association.
Louisiana Fire Prevention Bureau.
Louisiana State Society for the Reduction of Fire Waste.
Mainland Fire Underwriters' Association of British Columbia.
Mass. Assn. of Municipal Electrical Inspectors.
Massachusetts Mutual Fire Insurance Union.
Massachusetts State Fire Prevention Association.
Michigan Inspection Bureau.
Michigan State Fire Prevention Association.
Milwaukee Board of Fire Underwriters.
Minnesota State Fire Prevention Association.
Mississippi Inspection and Advisory Rating Company.
Mississippi Society for Prevention of Fires.
Missouri Actuarial Bureau.
Missouri Fire Prevention Association.
Mutual Fire Prevention Bureau.
National Association of Cement Users.
National Association of Credit Men.
National Association of Electrical Inspectors.
National Association of Local Fire Insurance Agents, The
National Association of Manufacturers of United States.
National Assn. of Master Gravel and Slag Roofers of America.
National Assn. Sheet Metal Contractors of United States.
National Board of Fire Underwriters.
National Convention of Insurance Commissioners.
National Electrical Contractors' Association.
National Electric Light Association.
National Hardware Association of U. S., The
National Implement and Vehicle Association.
National Paint, Oil and Varnish Association.
National Wholesale Grocers' Association.
Nebraska Inspection Bureau.
Nebraska State Fire Prevention Association.
New Brunswick Board of Fire Underwriters.
New England Bureau of United Inspection.
New England Insurance Exchange.
New Hampshire Board of Fire Underwriters.
New York Board of Fire Underwriters.
New York Fire Insurance Exchange.
North Carolina Fire Prevention Association.
North Dakota State Fire Prevention Association.
Nova Scotia Board of Fire Underwriters.
Ohio Inspection Bureau.
Ohio State Fire Prevention Association.
Oklahoma Inspection Bureau.
Oklahoma State Fire Prevention Association.
Ontario Fire Prevention Association.
Philadelphia Fire Underwriters' Association.
Philadelphia Suburban Underwriters' Association.
Rocky Mountain Fire Underwriters' Association.
South Carolina State Fire Prevention Association.
South Dakota State Fire Prevention Association.
South-Eastern Underwriters' Association.
St. Louis Fire Prevention Bureau.
Suburban Fire Insurance Exchange.
Tennessee Fire Prevention Association.
Tennessee Inspection Bureau.
Texas Fire Prevention Association.
The Union.
Underwriters' Assn. of the Middle Department.
Underwriters' Association of New York State.
Underwriters' Bureau of Middle and Southern States.
Underwriters' Bureau of New England.
Underwriters' Laboratories, Inc.
Virginia Fire Prevention Association.
Western Actuarial Bureau (Fire).
Western Canada Fire Underwriters' Association.
Western Factory Insurance Association.
Western Sprinklered Risk Association.
West Virginia Inspection Bureau.
West Virginia State Fire Prevention Association.
Wisconsin Inspection Bureau.
Wisconsin State Fire Prevention Association.

Table of Contents.

A High Pressure Watermain Break in San Francisco ..... Frontispiece

Editorial 5

Break in High Pressure Watermain 14

Public Education 15

Meeting of Executive Committee 21

Steamer Connections to Sprinkler Equipments 23

Comparative Statistics of Fire Loss 26

Conflagrations During 1912 33

A Flood Hazard 34

Fireproof Construction—What it is and What it Ought to be. *Edward T. Cairns* 35

Scuppers Save Water Damage 42

Panama-Pacific International Exposition. Plans for Fire Protection 43

Fire-Fighting in the Yukon. *Andrew Hart* 49

Electrical Inspection and the National Electrical Code 53

The New York Water System 59

Color, Paint and Varnish Factories. *F. E. Roberts* 61

Department of Fire Record 71

Volatile Liquids—Fire Record 73

Champion Coated Paper Mill Fire 114

Alcohol Fire. Special Report from Hudson Inspection Bureau 121

Points of Interest from Fire Reports 123

Standard Rules and Requirements 127

Post Office Department Statement 128

Reports on fires appearing in the Quarterly are copies of or extracts from written reports forwarded to the Association. This Association, as a body, is not responsible for the statements or opinions of any of its members.

A High Pressure Water Main Break in San Francisco.

Photograph from Fire Underwriters' Inspection Bureau (Member N. F. P. A.).

A High Pressure Water Main Break in San Francisco.
Photograph from Fire Underwriters' Inspection Bureau (Member N. F. P. A.).

The Quarterly

Vol. 7 July, 1913 No. 1

The Annual Meeting. The quality of the interest shown in the Seventeenth Annual Meeting held this year in New York City is adequately indicated by the published *Proceedings*, not only by its volume, which exceeds that of any published *Proceedings* for a number of years, but by the character and quality of the discussions.

The discussions this year were called out by the unusual character of the committee reports. The report of the Committee on Fireproof Construction, which has been in preparation and has been anticipated for a number of years, reflected great credit upon Professor Woolson's Committee. As was emphasized by the Chairman in his preliminary statement, the idea of the committee was to outline requirements for a building that would be actually fireproof and not fireproof in name only. This purpose not being clearly apprehended by a number of the members, precipitated the greater part of the discussion, the requirements being considered too stringent for ordinary purposes; but when it had been clearly impressed upon the convention that these specifications would produce a building the best of its kind, which might be modified for certain purposes and certain occupancies, the report was better understood and was received with enthusiasm. In moving the adoption of the report, Mr. W. C. Robinson expressed the general feeling of the members when he stated that the report represented, in his opinion, the first step of real progress the Association has made in this direction. This report and the discussions thereon make interesting reading.

The Committee on Safes and Vaults appointed last year brought in an interesting report, which is to be amended and extended by the committee during the current year. The principal difficulty before Mr. Forster's committee is that of making specifications for these devices in

the absence of the advantages of actual fire tests. It is possible that the Association may not consider it wise to prepare a standard for safes and vaults, but may instead desire to issue an advisory brochure on the subject similar to those initiated by the Committee on Manufacturing Risks and Special Hazards.

The Committee on Automatic Sprinklers, the Committee on Laws and Ordinances, the Committee on Explosives and Combustibles, the Committee on Signaling Systems, the Committee on Gravity Tanks, and the Committee on Hydrants and Valves completed the work undertaken last year.

The next edition of the standard on automatic sprinklers will contain the amendments adopted this year.

The various laws and ordinances received from the committee of that name will be published for promulgation during the summer.

The new and completed section offered by Mr. Dana's Committee on Gravity Tanks, covering specifications for concrete reservoirs, valve pits and tanks, will be published when the pamphlet on Gravity Tanks is re-issued.

The standards offered by the Committee on Explosives and Combustibles, covering proposed rules and requirements for gas shut-off valves, the proposed rules for storage and use of fuel oil and for the construction and installation of oil-burning equipments, and the rules and requirements for the construction and installation of dip tanks, indicate the valuable work of this committee during the year.

Mr. Sweetland's Commitee on Signaling Systems suggested amendments to the advisory pamphlet on Protection Against Lightning, slightly modifying the severity of the same respecting certain types of lightning rods which had given a good account of themselves in practice.

Mr. Lacount's Committee on Hydrants and Valves presented a complete revision of the rules and requirements covering these devices.

The Committee on Manufacturing Risks and Special Hazards, which has developed great usefulness under the direction of Chairman Benjamin Richards, presented its second brochure covering the subject of shoe factories. The value of this brochure is very great to the shoe manufacturer who may desire to safeguard his property.

Chairman Robinson of the Committee on Standards brought in a revision of the proposed standard for interior standpipe equipments, a very important and interesting subject. At Mr. Robinson's request this report is to go over until the next annual meeting and the members are urgently requested by him to give the same careful study, sending to him any criticisms or suggestions which may be prompted by the experience of the members. If a standard on standpipe systems can be adopted next year the Association will be able to make another extremely valuable addition to fire protection standards.

The committee appointed to draft Uniform Test Specifications for Determining Flash Point of Oils, Dr. Irving C. Allen, of U. S. Bureau of Mines, Chairman, completed its important work and has therefore

been discontinued. Seldom has a work of such importance been completed with such dispatch. Fortunately for the Association, Dr. Allen had been investigating this subject for a number of years for the Bureau of Mines, and the N. F. P. A. was able to reap in a single year the benefits of the research the chairman of this committee had given to the matter.

Mr. Chas. H. Patton's committee, appointed to revise the Association's old pamphlet on Field Practice, took a large and comprehensive review of its responsibilities, bringing in a remarkable report, the magnitude and value of which profoundly impressed the convention. When the second part of this report is completed the two sections will represent a manual of inspections for use in the field. To the first part of this report, printed in the *Proceedings*, the members are also asked to give their careful attention. It should be read in detail in the light of each member's experience in making inspections, and the criticisms and helpful suggestions sent to Chairman Patton. This is a work which, although undertaken in fine spirit by the committee, should be shared by every member of the Association capable of contributing toward it. It will perhaps represent, so far as daily service is concerned, the most useful and important publication ever issued by the Association.

The report of the Committee on State Fire Prevention Associations was made especially interesting by its extemporaneous delivery and the eloquence and enthusiasm of Chairman Drake. Our active members the State Associations are unusually fortunate in having a chairman who can give such an interesting account of their work in the field.

Brief reports were presented by the other committees and by delegates to the conventions of other bodies. The special addresses upon "The Social and Human Cost of Fire," by Miss Frances Perkins, and "Co-operation in Public Information," by David Knickerbacker Boyd, both contributed a distinct ethical and humanizing touch to the first day. Miss Perkins has the earnestness and spirit of the true constructive social worker and her appeal for the conservation of human life, following so closely the suggestion along the same lines of retiring President Phillips in his annual address, made a deep appeal to the members. Mr. Boyd's idealism, humor and impressive personality made his paper in its way equally as impressive. It sparkled with epigrams, good nature and wit. Our active member the American Institute of Architects could hardly have been better represented.

Our closer affiliation and comradeship with the architectural fraternity was newly cemented by the election to the presidency of Robert D. Kohn of New York. President Kohn's modest remarks on taking the chair after his election might lead one to assume that his interest in fire protection is of recent date. It will be remembered, however, that Mr. Kohn was a delegate from the American Institute of Architects to our Thirteenth Annual Meeting in New York City in 1909, and that his recognition by the Institute at that time was the result of his acknowledged interest in fire resistive construction. Mr. Kohn's election to the

presidency has brought forth the warmest commendation from the Association's members in all walks of life, particularly among the underwriters and the gentlemen in Mr. Kohn's own profession, among whom he long since won enviable distinction.

* * * * *

The Philadelphia Fire Prevention Congress. It will be noted by the reading of the report of the Executives given on another page that the invitation tendered the Association by the Philadelphia Fire Prevention Commission to attend the Fire Prevention Congress in that city, October 13th to 18th next, received such favorable consideration by the Executives as to lead them to appoint the entire Executive Committee, including the officers of the Association, as delegates. The interesting speech made at the annual meeting by Mr. Powell Evans, Chairman of the Philadelphia Commission, indicated the unusual quality of the work which the Commission has been carrying on in the Quaker City. On another page of the QUARTERLY appears a story of what the Commission has done toward educating the Philadelphia Fire Department in the use of outside standpipe and sprinkler connections, heretofore wholly ignored in Philadelphia. The Commission is a body working under authority of the Department of Public Safety and receives no compensation for its services. It thus has the unusual privilege of exercising its authority without political threat or interference. Such a work is made possible by the unusual character of the present city administration in Philadelphia.

The Fire Prevention Congress called by the Commission for October 13th to 18th has attracted wide interest and attention. It is an enlargement in the field of effort along the lines of fire prevention which marks an epoch in this work. Eight governors of states have expressed their intention to be present or will send their personal representatives.

The Fire Marshal Association of North America has voted to change its annual convention from Washington to Philadelphia, and the date f om October 3d to October 11th, so the members can attend in a body this Fire Prevention Congress. The National Chamber of Commerce of the United States and a number of its constituent bodies, and similar associations, have expressed their intention to be represented. A large number of underwriting bodies have expressed their intention of being present.

The field of discussion covers not only the physical standards which enter into building construction, protection, equipment and occupancy which has been the principal work of the N. F. P. A. for years, but it goes into the question of study and preparation of legislation for adoption in municipalities and states throughout the country, so that the police authority of the country at large may be directed hereafter to requiring a minimum attention to the fire hazard in the daily life of our congested cities.

This Congress has the sympathy of the National Government through its appropriate Bureaus in Washington, and several representatives will take part. It will not only afford an opportunity for the exchange of information and opinions between business, professional, government and underwriting authorities on this whole range of subjects, but it provides a ready means for filtering out the sum total of this opinion to the country at large for actual application and practice; and it will serve to focus the attention of the nation on the present useless waste from fire and the best course of action, physical, legal and moral, whereby the nuisance may be controlled and abated.

* * * * *

The Committee on Safety to Life. The action of the Executive Committee in creating the new Committee on Safety to Life was the crystalization of a latent feeling which has for some time existed in the membership and which was focussed directly at the annual meeting by the message of President Phillips and the speeches of Miss Perkins and Mr. Boyd, both of which referred directly to the responsibility of the Association toward giving attention to the life hazards of the subjects considered by the Association. In addition to this our Electrical Committee, after refraining for many years from directly considering the life hazards of electrical practice on the ground that an association organized to fight fire had no right to legislate concerning hazards to life, directly faced the problem at its meeting in March and gave consideration to a number of alterations in the National Electrical Code because of its feeling of responsibility toward the human factor.

It will be noticed that the Executives, in creating this new committee and placing it under the direction of so able and energetic a member as H. W. Forster, makes no attempt to dogmatize as to what the province of the committee shall be, but asks the committee itself to suggest the proper scope of its work. It seemed to be the feeling of the Executives that the work of the N. F. P. A. in accident prevention should be confined to items affected by fire. It may prove, however, that no clear line of demarcation can be drawn and that the full burden of our effort will be an "accident section" devoted to every phase of safety to life, including industrial and other accidents. It is possible that a number of our standards, notably the National Electrical Code, might advantageously be carefully gone over from the new point of view and many desirable amendments or qualifications interjected. However the work may develop, it is certain that many of our members are already showing an interest in it and it will be helpful to Chairman Forster if all members having ideas on the subject will communicate them to him. It is, of course, the intention of the committee actively to co-operate with all organizations now formed or which may be formed for the purpose of accident prevention.

Committee on Railroad Properties. For many years the fire inspectors of a dozen or more of the principal railroads of the country have been associate members of the N. F. P. A. and have from time to time contributed valuable information and assistance in our work. The wish of the gentlemen representing this interest for the creation of a special Committee on Railroad Properties was communicated to the Association last year through our Atlanta member, Mr. A. M. Schoen. At its last meeting the Executive Committee voted to establish such a permanent committee, and Mr. E. B. Berry, Chief Inspector of the Southern Railway Company, was made chairman. He was furnished a list of our railroad members and given authority to constitute his committee in any way best calculated to achieve the desired result. Simultaneously with this action a group of our railroad members, of which Mr. Berry is one, initiated a plan for a Railway Fire Protection Association, to be made up of representatives of all the railroads of the country. The following circular letter has just been addressed by the Committee on Organization to the railroad officials of the country having inspection work in charge.

The organization of an Association of those having in charge the insurance affairs of railroads, and more particularly the prevention of fires in railroad properties and protection of such class of properties against fire loss, has been contemplated for some time. To that end, at a conference of representatives of several railroads in New York City on May 14th last, a committee on organization was appointed, and at a meeting held in Washington, D. C., on June 2d, prepared a draft of Constitution and By-Laws for the proposed organization, a copy of which we enclose. The committee believes that such an organization, the main objects of which shall be,—

> "to promote the interest in and improve the methods of fire protection and prevention; to obtain and circulate information on these subjects, and secure the co-operation of its members in establishing proper safeguards against loss of property and life by fire, and especially to standardize practices through the interchange of ideas and experiences with regard to such matters in connection with railway properties,"

cannot only be of incalculable service to such railroad representatives, but work most beneficial results and a reduced cost in operating expenses to the railways in the joint study of these subjects of common interest.

This organization will be fashioned after and is proposed to bring about such harmony of action as has resulted in other similar railroad organizations.

A meeting on permanent organization is called for Tuesday, October 7, 1913, at Chicago, Ill., at a place to be arranged a later date of which you will be duly advised. We earnestly hope for your co-operation and advice to the Secretary that a representative of your company will be present at this meeting authorized to become a member of the Association.

Yours very truly,

COMMITTEE ON ORGANIZATION.

F. H. ELMORE,
Supt. of Insurance Sou. Ry. Co. (Secretary).

B. S. MACE,
Supt. of Insurance, B. & O. R. R.

ROBT. SCOTT,
Supt. of Insurance, A. C. L. R. R.

E. B. BERRY,
Chief Inspector, Sou. Ry. Co.

A. D. BROOKS,
Supt. Fire Protection, I. C. R. R.

C. B. EDWARDS,
Fire Insurance Agent, M. & O. R. R.

It is the purpose of the founders of this new Association that it shall become an active member of the N. F. P. A. with a voice and vote in our councils, and that the special Committee on Railroad Properties shall place the work of the new association before our members at our annual meetings in order that its activities may be registered in part in our published *Proceedings*. Those who are familiar with the special work done by the Pennsylvania Company, not only in fire prevention but in accident prevention, will realize how imperative is the need of such an organization as our railroad members are attempting to create.

* * * * *

The National Board's Great Work. The annual report of the Committee on Fire Prevention of our active member the National Board of Fire Underwriters again emphasizes the exceedingly valuable public work of this committee conducted through Chief Engineer George W. Booth and his assistants. Mr. Booth's excellent paper on Automobile Fire Apparatus, presented at the annual meeting, indicates one aspect of his work as director of this work. The demands upon his engineers for especial service (which it would seem there are not many competent to render) are made continuously. The city of Boston requested leave of absence of one of Mr. Booth's engineers, in order that the Hub might engage him to supervise the installation of the high pressure fire service system in that city. Another engineer on Mr. Booth's staff for over five years was similarly loaned to the Panama-Pacific Exposition as engineer-in-charge of water supply and fire protection for 1915. An article on another page of the QUARTERLY indicates the thoroughness of his work. Three of the engineers of this body attended the last convention of our active member the International Association of Fire Engineers and conducted for the Exhibits Committee the official tests of automobile pumping engines exhibited at that time. The fire engineers have also requested that the tests of engines and other apparatus at its coming convention in New York in September be conducted by the engineers of this committee. The New York Civil Service Commission also turned to Mr. Booth for the services of an expert to act as examiner of candidates for the position of Engineer-of-Steamer in the New York Fire Department.

The regular work of the Committee on Fire Prevention is always under way, as is evidenced by the frequent appearance of the neatly printed, white-covered reports on the various cities of the country. It would be impossible to carry on such intelligent and continuous educational work for an indefinite period without finally achieving favorable results, and in spite of the pitiful conditions lately existing in fire departments, water departments and buildings in the cities of the United States, the committee finds hope in the progress which has been made. Following is an extract from its last annual report:—

"In a number of cities the reliability and adequacy of the water supply has been very materially improved, and in most of them there is a general bettering

of the distribution system along the lines advocated in our reports; the tendency to devote more attention to the fire protection features of waterworks, especially among some of the larger cities and the more progressive private companies, is most encouraging.

"Fire departments have in general become more efficient through drills and training; the condition of fire engines and the ability of the men who operate them show marked improvement in a great many cities, and we believe that the tests conducted by our engineers are almost entirely responsible for this. Automobile apparatus is becoming every day a stronger factor in fire department operations, and in some cities has almost entirely replaced horse-drawn apparatus, with apparent increased economy and efficiency; the development of this feature as affecting organization and operation of fire departments is an interesting study. The general movement for increased wages and a greater number of days off in fire departments has resulted in an advanced maintenance cost, with a corresponding tendency to check the growth of department strength which ought to accompany increasing population; this may be counteracted to some extent by the installation of automobile apparatus, with its greater radius of action and economy of maintenance.

"A comparison of recent reports with those issued six or eight years ago shows that by reason of the erection of buildings of an improved type of construction, generally replacing old and weak buildings, the providing of window protection and the installation of other fire preventive equipment, conditions in many of the blocks which previously had a high conflagration hazard have been very materially bettered. In some instances a building classed as a conflagration breeder has been sprinklered, and in others a group of weak buildings has been divided by the erection of a building of improved type, equipped with automatic sprinklers and window protection. However, these improvements, whilst reducing the chances of a conflagration, have not been sufficiently radical as yet in any city to eliminate danger of spreading fires. The old construction common to our cities is, and for many years to come will be, weak from a fire prevention standpoint, but the improvement found in the new construction encourages the belief that by keeping such matters before the public the normal fire hazard of the American city may be brought more nearly to the plane of the European city."

* * * * *

Shingle Roofs in Birmingham. The report of the Committee on Fire Prevention of the National Board of Fire Underwriters on the city of Birmingham, Ala., issued in April, is a convincing argument for the prohibition of the use of shingle roofs. Subsequent to the issuance of this report, the city commissioners of Birmingham adopted an ordinance prohibiting the use of wooden shingles on the roofs of all buildings in Greater Birmingham. This ordinance is to go into effect on October 1st, but our advices do not state if the same is retroactive. An examination of the statistics of the above report shows that the gross fire loss is due to a large extent to a multitude of small fires. The number of fires is very high and has increased in almost exactly the same ratio as the population. The loss per fire has been moderate, but because of the large number of fires the resulting loss per capita has been high.

When the Secretary of the N. F. P. A. was in Birmingham last year, Chief Bennett of the Fire Department took him through one street of several blocks lined with wooden houses in which, in the last two years, shingle roof fires had occurred in every one. The Chief pointed play-

fully to the new shingle patches as his "trade mark." One April fire of this character, last year, spread to thirty-four frame buildings in the neighborhood, flying brands on shingle roofs being the distributing medium. The direct loss from this fire was $1,000, but the exposure loss was $21,686. The wind was high and six fire companies had all they could do finally to subdue the fire.

The statistics of fires show an average of 40.7 per cent of the actual fires occurred from sparks on roofs, the percentage increasing from 36 in 1908 to 45 in 1912; in addition, 12.2 per cent of the actual fires were from soot, defective flues, etc. For the three years 1910 to 1912, inclusive, the total number of fires from the above causes averaged 668 a year or 54 per cent of the total, and these fires represent an average yearly loss of about $190,000 or $1.30 per capita.

There has been for some time on the books of the city an ordinance requiring chimneys to be cleaned, and prohibiting the burning out of flues except when roofs are wet. The character of Birmingham coal makes it especially addicted to chimney fires. As the above ordinance is not enforced, it will be interesting to observe if the new ordinance regarding wooden shingles brings about the desired improvement.

* * * * *

Fire Marshal Laws. The report of the Fire Marshal of the state of Louisiana, beside pointing out the fact that Louisiana was the first state in the Union to enact the suggested state law on matches promulgated by the N. F. P. A., has this to say regarding the fire marshal's office and the character of its support:—

"As the General Assembly does not convene again until 1914, recommendations for amendments to the Fire Marshal law at this time may be considered premature, but I shall earnestly urge in my next annual report that the law be so changed as to make the Fire Marshal Department independent of and not dependent upon the fire insurance companies for its support, as is now the case. The existence of the department since its creation has been precarious, as the license tax levied upon the insurance companies for its maintenance and operation has always been questioned.

"The department should be absolutely independent. In keeping with this idea, the Fire Marshal Association of North America, thirty-two states of the Union being represented therein, has had prepared a uniform Fire Marshal law for adoption in all states, and I hope to see it made the law in this state. It embodies the best and most expert thought on the subject, and among other things provides for the support of the Fire Marshal department by direct appropriation by the Legislature."

Those who have been working for fire prevention realize more fully perhaps than others the justice of the Louisiana fire marshal's position. It is obvious that there is another effect of the support of this important public officer by the insurance companies which is equally, if not more, undesirable. This is the effect of the fact of such maintenance upon the people at large in confirming their belief that no one is, or should be, interested in the fire waste except the insurance companies. The fire

marshal's is an office which should be supported and directed by the people themselves, and the desired efficiency can hardly be looked for in any state in which it is not so conducted and financed.

* * * * *

Summer Conventions. Two of our active members are to hold their annual conventions shortly. The International Association of Municipal Electricians is to meet for its eighteenth annual session at Watertown, New York, August 19th to 22d. Our member, Mr. A. M. Paddon of Syracuse, will attend this convention as the fraternal delegate of the N. F. P. A.

Our active member the International Association of Fire Engineers expects to surpass all previous conventions at its forty-first annual meeting September 1st to 6th, next, in the city of New York. A considerable fraternal delegation will represent the N. F. P. A. this year, the following members having been appointed: George E. Bruen, Charles F. Danforth, F. M. Griswold, H. C. Henley, J. S. Mallory, W. C. Robinson, and H. L. Stanton. The election of Secretary James McFall, of the Fire Engineers, as a member of our Executive Committee brings us into closer relation with the actual fire-fighters, whose conventions are always full of lively interest.

Break in the Ten Inch High Pressure Water Main on O'Farrell St., San Francisco, April 29, 1913.

A contractor was clearing out and excavating an old vacant lot which had not been used since the fire of 1906. The street was held back by an old brick retaining wall. When he began excavating below this wall it caved in, allowing all the earth and pavement from the area wall back to the street car lines to fall into this excavation. This left approximately 150 feet of 10 inch high pressure main suspended in the air and it naturally broke of its own weight.

The present practice is to cut off, by means of gates at the corners, any block in which similar work is being done. As the high pressure is a gridiron system, with gates at each corner, any block may be cut out without affecting the remainder of the system.

When this break occurred the large amount of water rushing out under a static pressure of 180 pounds, carried away all other piping and conduits on that side of the street.

Approximately fifteen minutes elapsed from the time the break occurred to the time the water was shut off. When it is considered that this was the first accident the system has had, the work of the Fire Department appears to have been very creditable. (See Frontispiece.)

Public Education.

The action of the Executives outlined in the report of their last meeting, given in another column, appointing a Committee on Public Information, recommended by the last annual meeting, is intended to bring a powerful organized effort to bear upon the subject of public education.

As in all educative efforts, it is first necessary to develop the educators. The time for the work now to be undertaken was necessarily not ripe until the preliminary work of propaganda had been done.

Before any local committee work could be made effective it was necessary to have in each locality, where such a unit was to be organized, a certain person or number of persons sufficiently interested in the problem of the fire waste to devote the necessary time and energy to activity in the matter. Three years ago these co-operating persons had not yet manifested themselves. The work of the Secretary of the Association prosecuted for two years in succession throughout the country with the aid of our active member the National Association of Credit Men, followed by a similar campaign with the assistance of our active member the American Institute of Architects, resulted in an acquaintance in each state and city of importance, which may now be used as a nucleus for the organization of the local committees which are to work under the direction of the main committee on Public Information. The contributions to our work made by the Credit Men and the Architects are thus proving invaluable as the foundation for a large and organized effort.

The fact of the organization of the new committee and the comprehensive intent of its plans cannot at this time be considered as replacing the work of public education so far carried on by the writers and speakers among our members. In fact this phase of our work can now be extended and intensified by the opportunities for writing and speaking that can be secured by the local committees. In every state there is a large number of state, municipal and social organizations which are always looking for interesting matter for the programs of their sessions. The question of the fire waste has never yet to our knowledge been brought to the attention of the officers of any such body but a response in the form of an invitation to bring the matter before them has resulted. Considering the proportions of the fire waste still recorded by each year, there is still vital need not only of every form of spoken and written

public education but also for the special efforts to be undertaken by the new committee.

* * * * *

On invitation of the Halifax, Nova Scotia, Board of Trade, Secretary Wentworth visited Halifax on June 12th to address a special meeting under the auspices of that body, called for consideration of the question of the fire waste, the proportions of which are beginning to be recognized by the Canadian people. A special journey from Toronto was made to this Halifax meeting by Mr. Robert S. Gourlay, President, and Mr. G. M. Murray, Secretary of the Canadian Manufacturers Association, under whose auspices Secretary Wentworth's speaking tour of Canada was made last year. President Gourlay presided at the meeting in Halifax and impressed upon the local authorities the importance of the work initiated by the Canadian Manufacturers.

Mr. Reginald V. Harris, a member of our Canadian Committee, is Secretary of the Nova Scotia Branch of the Canadian Manufacturers Association and a member of the Board of Control of the city of Halifax. At the meeting of the Board of Control, immediately following the Board of Trade meeting, the resolution was passed authorizing Controller Harris to represent the Board of Control for consultation with representatives selected for the same purpose by the Board of Trade, Canadian Manufacturers Association and the Nova Scotia Board of Fire Underwriters, and to submit to the Board of Control such proposals or amendments to ordinances as are calculated to lessen fire risks in Halifax. Our Canadian neighbors have the habit of acting promptly as soon as the necessity for action is once impressed upon them.

* * * * *

One of the most devoted propagandists in fire prevention is Mr. D. C. Shaw of D. C. Shaw and Co., wholesale grocers of Pittsburg. Beside many courtesies shown to Secretary Wentworth during his visits to Pittsburg, Mr. Shaw is exceedingly active on his own account. He delivered a special address on fire prevention before the Pittsburg Board of Trade in May, which resulted in the passage of a resolution empowering the Chairman of the Board of Trade to appoint a Committee on Fire Prevention. Mr. Shaw has also persistently kept the important question of the fire waste before the annual meeting of the National Wholesale Grocers' Association and at their convention of this year secured the passage of a resolution favorable to the co-operation of the National Wholesale Grocers' Association as an active member of the N. F. P. A. Mr. Shaw expresses the belief that this action will open the way to a consideration of the fire waste by the various state Wholesale Grocers' Associations.

* * * * *

Mr. Frank M. Drake, Vice President of the Association and Chairman of our imporant Committee on State Fire Prevention Associations, delivered an address to the Institute of County Superintendents of Schools

in Kentucky early in April and secured consideration of the matter of the study of fire prevention in the rural schools of Kentucky during the summer term. Chairman Drake is endeavoring to obtain the co-operation of his Committee in securing a place upon the programs of the local educational conventions of the country. There were present at the time of Mr. Drake's talk the governor of the state and several other state officials.

* * * * *

Another new influence at work in Kentucky is the Kentucky Manufacturers' and Shippers' Association, Walter P. Dickerson, General Secretary, Newport, Ky. This Association requested this year for the first time a speaker on the subject of fire prevention. Mr. Drake was delegated to render this service, but owing to a railroad accident was unable to keep the appointment. The matter was ably brought before the meeting by Mr. Young E. Allison of the *Insurance Field*, who, although scheduled to speak on the subject of fire insurance, outlined in connection with his address the matter of the fire waste. Subsequent to the meeting the Manufacturers' and Shippers' Association issued a brief calling the attention of its members to the importance of fire protection and prevention.

* * * * *

A number of our members appeared this year as speakers at the spring meeting of the American Society of Mechanical Engineers held in Baltimore, Md., the week of May 20th. Papers and addresses were presented at this meeting by our members Albert Blauvelt, F. M. Griswold, H. F. J. Porter, C. H. Smith and Ira H. Woolson.

* * * * *

Mr. H. W. Forster, Chairman of our Committee on Safes and Vaults, also Chairman of our important new Committee on Safety to Life. delivered an interesting paper on "The Fireproof Building; Its Advantages and Weaknesses," before the Engineers Society of Western Pennsylvania on March 4th. The address has been printed in the Proceedings of the Society, and we hope to have the privilege of reproducing liberal extracts from the same in the next issue of the QUARTERLY.

* * * * *

Mr. Powell Evans of our Executive Committee, Chairman of the Philadelphia Fire Prevention Commission, addressed the Convention of the Pennsylvania State Fire Insurance Agents at Altoona, Pa., in June.

* * * * *

Our new active member the Ontario Fire Prevention Association has given a good account of itself since its organization. The Association prevailed upon the mayor of Toronto to declare April 25th as "Clean-Up Fire Prevention Day." This year is the ninth anniversary of the Toronto conflagration which broke out in a Wellington Street warehouse on April 19, 1904, went across the lane into a greater building

and spread in all directions in the wholesale district of the city. A red card was widely distributed on "Clean-Up Day" by the Ontario Fire Prevention Association. Through the co-operation of the Chief Inspector of Schools, the school children received special instruction that day on the dangers of fire.

The members of the N. F. P. A. had the pleasure of meeting the Secretary of this organization, Mr. W. Walker, at the annual meeting. The latter, with the Canadian member of our Executive Committee, Mr. E. P. Heaton, visited Brantford for a special meeting of the Board of Trade about the middle of April. The meeting was largely attended and the speeches,—that of Mr. Heaton's especially,—were given generous space in the local newspapers. There is no question that our new active member has already abundantly justified its existence.

* * * * *

Our Boston member Mr. Joseph K. Freitag, author of the valuable and well known Hand-Book on Fire Prevention and Fire Protection, has prepared interesting stereopticon lectures on the subject of fire prevention and the fire waste which have already been delivered both at Harvard College and at Mr. Freitag's own Alma Mater, the University of Michigan. It is Mr. Freitag's intention to deliver the same or similar lectures during the coming season at other engineering and architectural schools and possibly before architects and builders, should the same be desired. Mr. Freitag's lecture at Ann Arbor before the engineering and architectural students, created so much interest in the subject of fire protection that he was asked to give a course of lectures there on the same subject during the coming winter.

The value of the stereopticon in assisting the listener to a clear understanding of fire protection is very great. Protective devices can be much more clearly understood by means of such illustration, which greatly aids the spoken descriptions.

Mr. Freitag's disinterested work is an exceedingly valuable contribution to the cause.

* * * * *

Messrs. Heap and Digby, engineers, 48 Westminster Palace Gardens, London, England, have been appointed Agents and Engineers for Underwriters' Laboratories in Great Britain and Ireland. The establishment of a Laboratories' office in England is made in response to recommendations of the British Trade Commissioner in Canada, and in accordance with desires expressed by a number of manufacturers in England who are exporting goods which properly come within the scope of the examination and test work carried on by the Laboratories. Messrs. Heap and Digby are well and favorably known both in England and America as active in all branches of engineering work. Mr. Arthur C.

Heap, the Senior member of the firm, has made two visits to the United States and Canada recently, inspecting electrical apparatus being built for power transmission plants in England.

* * * * *

A permanent Fire Prevention Committee has been formed in Montreal. Organization took place at a meeting held in the rooms of our active member the Canadian Manufacturers Association, when delegates representing the Board of Trade, the Chambre de Commerce, the Architects' Association, the Builders' Exchange, the Canadian Fire Underwriters' Association and the Canadian Manufacturers Association were present. A resolution was passed to the effect that the various organizations represented be asked to appoint three delegates to act permanently on a Fire Prevention Committee, the convener of the committee to be the chairman of the local branch of the Manufacturers Association.

The representatives were asked to report at once to their different organizations and to ask for their approval to the movement, in order that the work of the committee may be started at once.

* * * * *

Mr. Albert E. Crane of Bloomfield, N. J., appeared before the Board of Trade of that city at its April meeting and delivered a well written address on the subject of the fire waste, pleading for the appointment of a new standing committee on fire prevention. Subsequent to the delivery of the address the Board of Trade took the desired action and appointed Mr. Crane himself, who is a member of the body, as Chairman of the Fire Prevention Committee.

* * * * *

The province of Saskatchewan, Canada, issues at its capital, Regina, an interesting public service monthly in which are chronicles of the activities of the departments. In the issue for June appears an excellent article by Fire Commissioner J. McLean. Commissioner McLean says:—

"For several years Manitoba has stood alone among Canadian provinces in the matter of having fire prevention legislation. Saskatchewan has followed suit by enacting an Act along the same lines and appointing a fire commissioner, whose duties it is to investigate all fires, where necessary, with a view to determining their cause. Furthermore, a record of all fires occurring in the province shall be kept and shall be available for public inspection. During the three months that the office has been in operation considerable progress has been made and hearty co-operation has been given by insurance companies, civic and municipal authorities and fire chiefs. A bulletin, issued to upwards of thirty cities and towns in the province, urging the necessity of a clean-up or fire prevention day, met with a hearty and loyal response in most cases, and, doubtless, much good has resulted. A by-law, providing for systematic inspections of premises by the members of the fire departments and regulating many conditions which constitute a fire menace, has been submitted to the cities of the province. To Prince Albert belongs the

credit of having promptly adopted it almost *in toto*, whilst other cities have it under consideration. The attainment of as uniform a standard as possible of fire prevention by-laws and regulations is a consummation 'devoutly to be wished' and, to this end, an effort will be made to bring the subject before every town and village council in the province."

* * * * *

Our associate member the Rochester Chamber of Commerce is not in any way relaxing its work for fire prevention which has already so forcibly impressed the citizens of that interesting city. The Fire Prevention Committee sub-divided itself into inspection groups during the week of May 26th, which was Clean-Up Week, and subsequently reported one hundred and fifty bad spots needing either the services of the fire marshal or the health officer of the city. The findings of the Committee indicate that the work for fire prevention must be continuous. Commenting on the above, Assistant Secretary Barstow says:—

"We are facing this thing without any self-deception, and we are going to do everything in our power to keep the condition of the city as safe as possible. We believe that it is foolish on the part of a commercial organization to try to gloze over facts that face it or to lie about them. We are not a mutual admiration society, and consequently while we are not pessimistic or downcast about the situation, we are telling our members frankly what we find and are urging them to get down to work to try to improve things."

* * * * *

No feature of the rapid development of interest in fire prevention is more encouraging than that shown by the public schools, normal schools and colleges of the country. In the town inspections made by the various state prevention associations, an address to the school children on the common fire hazards is usually made one of the principal features of the program.

The Committee on Publicity and Education has distributed hundreds of thousands of pieces of literature through the schools. In preparation for the observance of fire prevention day in Wisconsin this year it furnished 5,000 copies of its recently issued "Fire Stories for Children," which are being sent out to every school in the state, with instructions for their use on the fire prevention program, together with other material supplied by the committee.

* * * * *

Colonel B. W. Dunn, of New York, Chief Inspector of the Bureau of Explosives and Combustibles of the American Railway Association, and a member of several of our important committees, has been elected to membership in the Council of Underwriters' Laboratories. The work in safeguarding life and property which the railway companies have been carrying forward through Colonel Dunn's Bureau is similar in many respects to that undertaken by some departments of the Laboratories. The addition of Colonel Dunn to the Laboratories' Council is expected to aid the establishment of uniformity in fire prevention engineering practices.

Meeting of Executive Committee.

A meeting of the Executive Committee was held in New York City on June 23d, the following members being present:—

F. J. T. Stewart, New York, Chairman.
Powell Evans, Philadelphia.
E. B. Hatch, Chicago.
C. A. Hexamer, Philadelphia.
W. E. Mallalieu, New York.
Charles E. Meek, New York.
Elliott Middleton, Memphis.
Louis Wiederhold, Jr., Philadelphia.
Robert D. Kohn, New York, President.
Frank M. Drake, Louisville, Vice President.
Franklin H. Wentworth, Boston, Secretary-Treasurer.

Mr. H. W. Forster and Mr. R. H. Newbern, both of Philadelphia, were present as guests.

The committee was entertained at luncheon at the Drug and Chemical Club by Mr. Charles E. Meek and at dinner at the Engineers' Club by Mr. Powell Evans. An evening session was necessary to complete the business of the meeting.

The principal items considered, with action thereon, are given below:—

The majority report of the Committee on Laws and Ordinances covering the suggested ordinance "to regulate the use, handling, storage and sale of inflammable liquids and the products thereof," was adopted and recommended to the National Board of Fire Underwriters for publication.

It was voted to authorize publication of brochure on shoe factories when recommended in final form by Committee on Manufacturing Risks and Special Hazards.

It was voted that the Committee on Explosives and Combustibles be requested to prepare a standard for kerosene oil engines.

The following subjects were referred to the Committee on Explosives and Combustibles:—

1. Modification of rules covering storage of nitro-cellulose films in limited quantities.
2. Matter of a standard for self-heated gas irons and flexible metal tubing therefor.

The following subjects were referred to the Committee on Manufacturing Risks and Special Hazards:—

1. Automobile Garages.
2. Cold Storage Warehouses.
3. Ventilating Ducts for Kitchen Ranges.

It was voted to create a Committee on Railroad Properties.

It was voted that the Electrical Committee be requested to suggest a date upon which amendments to the National Electrical Code shall become effective, and to notify as far as possible all interests affected.

The Committee on Amendments to Articles of Association was asked to give consideration to the matter of—

1. Changing the Association's name to National Fire Prevention Association.
2. Revising the articles covering qualifications for active and associate membership.

The officers were asked to consider the advisability of the Association appointing a counsel to pass upon the legal status of suggested laws and ordinances, with candidates and terms of employment, and report to Executive Committee.

It was voted to appoint a Committee on Safety of Life, empowered—

1. To consider advisable modifications of our existing standards in order to provide for safety of life.
2. To consider additional standards on safety of life, with particular reference to exit facilities and housekeeping methods.
3. To consider co-operation respecting accidents through fire, with existing bodies organized to study industrial or other accident prevention.
4. To recommend for adoption by the Executive Committee a definite statement of the field of the Committee's investigations and activities.

In accordance with authority given by the last annual meeting, it was voted to appoint a Committee on Public Information with the Secretary of the Association as chairman, to be empowered—

1. To organize state, provincial and municipal sub-committees and provide for the support thereof.
2. To encourage legislation for the enforcement of fire prevention and fire protection standards and inspection and good housekeeping conditions.
3. To agitate for the continuous and regular enforcement of such legislation when passed.
4. To take such other steps to further the ends of education, legislation and its enforcement for the protection of life and property against loss by fire as the Committee may deem wise.

The following resolution was adopted:—

WHEREAS, an invitation has been received from the Philadelphia Fire Prevention Commission to a congress in the interests of fire prevention to be held in Philadelphia October 13-18; and

WHEREAS, as a result of the Executive Committee's discussion of the same, we understand that the powers delegated to the new Committee on Public Information are sufficiently broad to include the propaganda work which it is intended to spread by means of this Congress; and

WHEREAS, we are also given to understand as a result of this discussion that there is now no intention on the part of the Philadelphia Fire Prevention Commission to encourage the formation of a separate or new fire prevention association;

It is RESOLVED that the Executive Committee co-operate with the Philadelphia Fire Prevention Commission respecting the said Congress, and that the entire Executive Committee be hereby elected as delegates to attend the same.

The following members were appointed fraternal delegates to the Convention of the International Association of Fire Engineers: Geo. E. Bruen, Charles F. Danforth, F. M. Griswold, H. C. Henley, J. S. Mallory, W. C. Robinson and H. L. Stanton.

Mr. A. M. Paddon was appointed fraternal delegate to Convention of International Association of Municipal Electricians.

The matter of preparation of bulletin on fire escapes was referred to the Committee on Safety to Life.

The following committees were discontinued:—

1. Automobile Garages.
2. Cold Storage Warehouses.
3. Uniform Test Specifications for Determining Flash Point of Oils.

Existing committees were continued, with revisions; and members of the same, with roster of newly created committees, will appear in the Year Book now in preparation.

Steamer Connections to Sprinkler Equipments.

Important Work of Philadelphia Fire Prevention Commission.

The Philadelphia Fire Prevention Commission, acting in an advisory capacity to the Department of Public Safety, revealed by the statistics gathered the fact that twenty per cent of all insurable value in the city of Philadelphia was protected against fire loss by automatic sprinklers. Their findings also noted that while there were several hundred steamer connections attached to these sprinkler systems all ready to direct water under pressure from the engines to the seat of the fire through sprinkler pipes, and that these steamer connections had been installed during the past thirty years, yet the fire department *had failed to use this ready and effective adjunct means of fire fighting in a single instance.*

These conditions and the often demonstrated value of an automatic sprinkler system discharging water under high pressure, also the fact that a steamer connection when attached to the low pressure of city mains, with a fire engine interposed, served to furnish the sprinkler system with practically an inexhaustible water supply under high pressure, dictated one of the first activities of this commission. An investigation of the subject proved that the fire department in many cities had established

rules of action for the use of the steamer connections on sprinkler systems in event of fire, and it required considerable correspondence to bring out the merits of the somewhat variable rules of action. The Director of the Department of Public Safety, upon the advice of the Commission, issued on April 14th an order as follows:—

Immediately upon the arrival of the first steamer the first line of hose shall be run into the building in accordance with the usual practice, and at the same time the second line of hose shall be connected to the sprinkler connection and a pressure of 100 pounds immediately placed on the sprinkler system—this pressure to be increased to 140 pounds if the commanding officer deems additional pressure advisable.

NOTES:—

No. 1. The standard outside sprinkler connection is what is called a Siamese or twin "Jones" coupling-snap connection. These are similar single connections. Water passes through this connection past the automatic check valve into the system as an adjunct supply to any other water supplies on the system.

No. 2. Assignments have been made of inspectors from each fire house to go through each building listed as equipped with automatic sprinklers, so that each fire house will know the controlling valves, the main pipe lines and branch lines, and also the location of sprinkler connections.

No. 3. When there is more than one connection on a building the commanding officer shall make sure that the connection is made to the automatic sprinklers. It is the duty of the officer in command in case of fire to maintain pressure on the sprinkler system, where such exists in any building on fire, until the fire has been extinguished; and thereupon promptly to shut off the water supply from the line on which sprinklers are open, by closing the controlling valve—preferably a branch valve—but if this cannot be done, then the main valve.

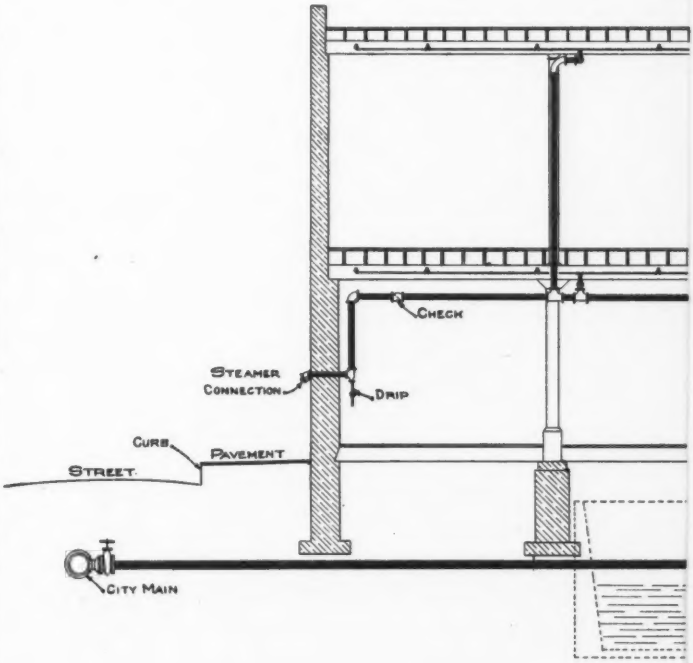
No. 4. A member of the fire department is to remain at any building equipped with such water supplies until the system is again in operative condition.

No. 5. It is the duty of the entire fire fighting force to familiarize themselves with the primary principle of automatic sprinkler protection so as to avail themselves of these instructions in a completely intelligent manner. Such information is freely obtainable at the Fire Prevention Commission headquarters, Room 420, City Hall.

No. 6. It is not the intention of the department at this time to apply the above instructions to standpipe systems, due to their lack of uniformity and their uniform lack of maintenance conditions for such adjunct use. It is the purpose of the department in time to use their influence to have such standpipe systems brought up to the necessary point of uniformity and maintenance conditions as to warrant their adjunct use.

The value of this additional water supply was of course better realized by the owners of properties who for years had enjoyed automatic sprinkler protection, and to remove existing incredulity of the fire department of the effectiveness of the steamer connection a test was arranged by the courtesy of Merchant & Evans Company at their Philadelphia plant. The test consisted of opening by actual fire four sprinklers, allowing first the gravity tank which delivered water under twenty-eight pounds pressure to demonstrate its distribution through these open heads, then upon orders of the officer in charge of the fire engine that had been brought to the scene, first one line of hose and then a second line from the fire engine was put to work through the steamer connection. The pressure at the engine, 100 pounds, prevented the water from the tank passing its

SKETCH SHOWIN
SPRINKLER SYSTE
AND
WATER SUPPLIES

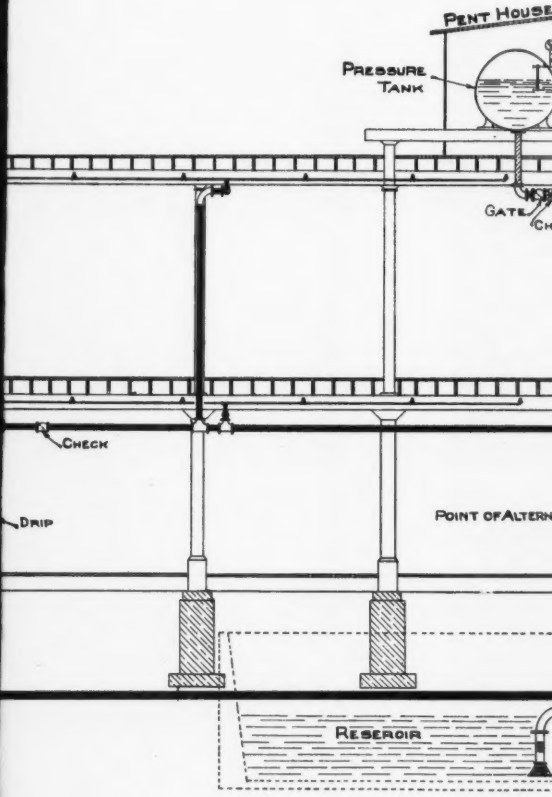


SKETCH FROM PHILADELPHIA F

DIAGRAM OF WATER SUPPLIES TO

**The above diagram is not intended to represent a standard equipme
Philadelphia Fire Department how water from different**

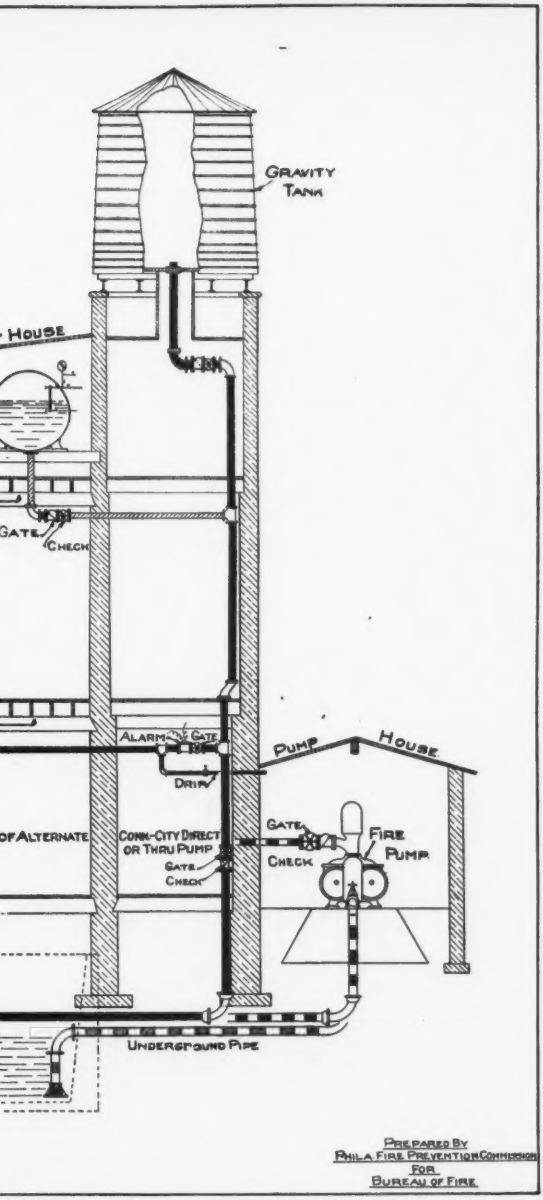
SKETCH SHOWING
SPRINKLER SYSTEM
AND
WATER SUPPLIES



SKETCH FROM PHILADELPHIA FIRE PREVENTION COMMISSION

F WATER SUPPLIES TO AUTOMATIC SI

ed to represent a standard equipment. It is a rough sketch
Department how water from different sources of supply may



MMISSION.

IC SPRINKLER SYSTEM.

sketch used in teaching the new inspectors of the
y may be fed into sprinkler systems.

check valve and clearly demonstrated to approximately 200 members of the fire department, and many insurance and business men present, what could be expected by the action of the fire engines to the steamer connection. Fortunately, Merchant & Evans Company had a large brick paved yard roofed over, thoroughly sprinklered, and they permitted the opening of a dozen sprinklers, for a second larger test, into wh ch water was first allowed to pass from the tank and then from the fire engine, with greater pressure through the steamer connection, as above explained. Another feature which dictated the selection of the place where the test was made in the face of many similar offers, was the presence of an eave window curtain system, which by test brought forth the remark from the various fire chiefs present that one line of hose working through the steamer connections was more effectively protecting twenty-four window openings with less actual handling than could be obtained without the sprinklers for one window by the direct efforts of a nozzle stream.

The very fact that steamer connections on sprinkler systems had never been used by the fire department, accounted for their being in some cases in unworkable condition, and by the courtesy of the insurance companies a complete list of sprinklered risks in the city was furnished the Fire Prevention Commission, who immediately detailed six men to different sections of the city to visit each risk and report to the owner the condition of steamer connection, calling particular attention to the need of immediate repairs, without which they could not be given the service of the engines through their sprinkler pipes. The immediate interest this order aroused in the fire department made it evident that they should be schooled upon the rudimentary principles of automatic sprinkler operation, so that in the confusion that attends the average fire, even when the employees who have a knowledge of the system are present, or in their absence at night, the firemen could intelligently manipulate the necessary valves of these sprinkler systems and prevent excessive water damage. A plan, cut of which accompanies this article, was prepared, and twelve volunteers, *i. e.*, trained engineers on sprinkler protection from the insurance and business interests, started to visit each fire house in the evening when full membership was assured, lecturing on the essential general features of piping, valves, supplies, etc., of a sprinkler system. This work covered a period of two weeks. A copy of the plan was left at each house, and many of the officers and firemen took occasion on their days off to visit the Commission rooms for further enlightenment, showing an interest that could only be productive of good results.

The next step was the addressing a letter to every owner of an automatic sprinkler equipment in Philadelphia, advising of the new order, calling attention to the necessity of having their steamer connections placed in operating condition, and requesting a plan or sketch of the property indicating the location of the steamer connection and the main and sectional controlling valves. The general response to this request placed in the hands of the Commission several hundred plans and accompanying letters of explanation which were distributed through the Bureau

of Fire to the fire company which would respond in the event of a still alarm (nearest company to risk), or which would naturally be the nearest company in the event of a box alarm which calls out several companies. A general letter to the officers of each fire company was sent with the plans, containing instructions that the officers immediately arrange to visit each risk in their territory and familiarize themselves with the plan by actually checking it at the property. The acting Chief of the Bureau of Fire has made further arrangements with the nearest fire company to a sprinklered risk to exchange their sprinkler plans with the company next nearest for the same purpose of visiting the premises and learning all about the proper manipulation of the important features of the sprinkler systems; the idea being that if the first company is at another service fire, in the event of a sprinklered risk alarm the second company would also be in possession of the information required to intelligently handle adjunct fire fighting apparatus. One large class of sprinklered risks (Mutual) have, owing to the non-use of steamer connections, not provided this feature on their equipments, but upon the promulgation of the order within the fire department, the office having jurisdiction immediately made known to all their subscribers the desirability of adding this valuable feature, and the next few months will probably mark the addition of steamer connections on the several hundred risks they control.

Comparative Statistics of Fire Loss.

American and Foreign.

The Committee on Statistics of the National Board of Fire Underwriters recently submitted their annual report on the fire losses for the year 1912. In accordance with our usual custom we present herewith a careful analysis of the same, feeling that our members may find these figures of much interest and value in advocating, where necessary, improved fire department equipment, increased water supplies, better building regulations, and mandatory fire preventive laws for cities in their localities. These figures afford comparisons and point out the necessity for improvements if the fire losses are to be equalized in cities of the same size.

We also present a table showing the comparative fire losses of various foreign countries and the United States, and a study of fires in foreign cities. While the causes for the difference in the fire losses of cities in this and other countries are recognized, the foreign record of values destroyed emphasizes the virtues of better building construction methods, better housekeeping, and the holding responsible those who destroy by fire either their own or others' property.

The per capita loss for the 302 cities of 20,000 population and over in the United States was $2.55. This was seven cents less than in 1911,

but still sixteen cents greater than in 1910. The per capita loss for the whole country was estimated at $2.16. The Dominion of Canada is now laboring under a greater fire loss than any other country from which records are available. The per capita loss for the principal Canadian cities is $2.88. The principal cities of England, France and Germany have an average per capita loss of fifty-four cents, eighty-four cents and twenty cents respectively.

In a group of twenty-eight cities of the country having a population of 200,000 or over, Providence stood the highest with a per capita loss of $4.80; Kansas City came next with a per capita loss of $4.77; and Boston was third with a per capita loss of $3.61. In 1911 Providence stood next to the lowest. The average per capita loss for this gr p of twenty-eight cities was $2.37, which was five cents less than the average for 1911, and the per capita loss in thirteen of these cities was greater than the average. The city in this group having the smallest per capita loss was St. Paul, which was thirty-seven cents. Rochester came next with $1.11, and New Orleans had a per capita loss of $1.29. The ten cities having a population over 200,000 and less than 300,000 had a per capita loss of $2.82.

In a group of eighteen cities having a population of 300,000 or over, the average per capita loss was $2.30, which was nine cents under that of 1911. In this group eight cities have a greater per capita loss than the average for the group. Boston had the largest per capita loss; Minneapolis came next with a per capita loss of $3.57; and Newark was third with a per capita loss of $2.92. New Orleans holds minimum place here, with Baltimore next having a per capita loss of $1.59 and Washington third from the lowest with a per capita loss of $2.92. The seven cities having a population over 300,000 and less than 400,000 had a per capita loss of $2.33.

In a group of eleven cities having a population of 400,000 or over, Boston had the largest per capita loss; Detroit came next with a per capita loss of $2.69; and Chicago was third with a loss of $2.59 per capita. Baltimore again made the best showing in this group, and Buffalo came next with a per capita loss of $1.89. Philadelphia was again third from the lowest with a per capita of $1.93, which was forty-six cents greater than last year. The average per capita loss for this group is $2.29, which is two cents higher than last year. Five of these cities had a per capita loss greater than the average for the group.

The smallest per capita loss reported in any city with a population of 20,000 or over was in Savannah, Ga., a city of 67,000, which had a per capita loss of eighteen cents. Oshkosh, Wis., a city of 34,000, came next, with a loss of twenty-two cents; and Reading, Pa., with a population of 100,000, had a per capita loss of twenty-three cents. The cities which enjoyed the lowest per capita loss in 1911 had a loss of fifty-five cents, $1.73, and twenty-five cents, respectively, this year.

The following is a list of American cities which experienced a fire loss of over a million dollars during the past year:—

City.	Aggregate Loss.	Per Capita Loss.	No. of People Per Each Fire Alarm
New York	$11,827,944	2.24	338
Chicago	6,162,561	2.59	207
Houston	4,602,695	51.14	114
Philadelphia	3,081,412	1.93	463
Boston	2,351,060	3.61	164
Canton, O.	2,031,737	36.94	219
St. Louis	1,509,088	2.01	160
Cleveland	1,485,045	2.43	250
Detroit	1,347,622	2.69	191
Kansas City	1,263,466	4.77	86
Pittsburg	1,198,201	2.12	263
Minneapolis	1,155,203	3.57	148
Providence	1,104,765	4.80	132
Newark	1,095,667	2.92	348
San Francisco	1,035,233	2.38	243

These fifteen great American cities represent one-seventh of the population of the country. The aggregate fire loss last year was the stupendous sum of forty-one and a quarter million dollars, with an average per capita loss of $2.92.

The following table shows the thirty cities which had a per capita loss over $5 during 1912, as compared with the thirty-four cities which had a loss of over $5 per capita in 1911, and the thirty-three cities which fell in this class in 1910. Massachusetts has held the unenviable record for two years of having the greatest number of cities in this class.

Cities in Which Loss Exceeded $5 Per Capita.

1912.

*Houston, Tex.	$51.14	Waterloo, Ia.	$6.71
Canton, Ohio	36.94	Fort Smith, Ark.	6.63
North Adams, Mass.	15.41	†Dallas, Tex.	6.32
Sioux City, Ia.	12.69	Shreveport, La.	6.05
*Petersburg, Va.	11.71	Belleville, Ill.	5.87
Moline, Ill.	11.60	Easton, Pa.	5.66
*Ottumwa, Ia.	10.65	*South Bethlehem, Pa.	5.66
Flint, Mich.	10.38	*Birmingham, Ala.	5.57
Butte, Mont.	9.84	*Meridian, Miss	5.54
Columbia, S. C.	9.69	Norwood, Ohio	5.32
Pittsfield, Mass	9.13	Rockford, Ill.	5.20
Columbus, Ga.	8.67	Taunton, Mass.	5.06
*Fresno, Cal.	7.75	*Tacoma, Wash.	5.04
Perth Amboy, N. J.	7.15	Newport, R. I.	5.01
Walla Walla, Wash.	6.74	Haverhill, Mass.	5.01

1911.

*Bangor, Me.	$137.43	*Sheboygan, Wis.	$11.30
*Houston, Tex.	44.50	Paducah, Ky.	11.15
Winona, Minn.	21.08	Port Huron, Mich.	10.73
Little Rock, Ark.	17.24	Ogden, Utah	10.36
Dubuque, Ia	15.01	South Omaha, Neb.	10.13

* These cities in this class in two of the three years.
† In this class three successive years.

Council Bluffs, Ia.	$8.88	Wichita, Kan.	$6.47
Gloucester, Mass.	8.46	Battle Creek, Mich.	6.35
Leavenworth, Kan.	8.14	*South Bethlehem, Pa.	6.25
Troy, N. Y.	8.07	Racine, Wis.	6.06
Malden, Mass.	7.53	Gloversville, N. Y.	6.05
Kalamazoo, Mich.	7.52	San Jose, Cal.	6.01
†Dallas, Tex.	7.07	Salem, Mass.	5.63
*Minneapolis, Minn.	6.74	Duluth, Minn.	5.52
Muskogee, Okla.	6.67	Reading, Pa.	5.48
*Ottumwa, Ia.	6.55	*Birmingham, Ala.	5.24
*Amsterdam, N. Y.	6.49	Brookline, Mass.	5.14
Superior, Wis.	6.47	*Atchison, Kan.	5.09

1910.

Vicksburg, Miss.	$18.60	*Bangor, Me.	$6.21
*Petersburg, Va.	14.85	*Atchison, Kan.	6.11
Jamestown, N. Y.	12.38	*Tacoma, Wash.	5.93
Portsmouth, Ohio	10.81	Norfolk, Va.	5.92
Kansas City, Kan.	8.89	Rockford, Ill.	5.87
Stockton, Cal.	8.88	El Paso, Tex.	5.76
*Fresno, Cal.	8.23	Omaha, Neb.	5.73
Everett, Wash.	7.74	*Sheboygan, Wis.	5.58
†Dallas, Tex.	7.39	Danbury, Conn.	5.46
Spokane, Wash.	7.37	Paterson, N. J.	5.46
Wilmington, N. C.	6.62	Lynchburg, Va.	5.37
*Amsterdam, N. Y.	6.61	Cincinnati, Ohio	5.24
*Minneapolis, Minn.	6.60	Boston, Mass.	5.15
Lima, Ohio	6.57	Evansville, Ind	5.14
East Liverpool, Ohio	6.56	*Meridian, Miss.	5.11
Memphis, Tenn.	6.46	Waco, Tex.	5.02
Burlington, Vt.	6.22		

The average per capita losses in those states having several cities with a population of 20,000, or over, were as follows:—

	1910.	1911.	1912.
Massachusetts, 29 cities	$2.77	$2.47	$2.15
Connecticut, 10 cities	2.08	2.20	1.90
‡New York, 26 cities	1.95	2.40	2.16
New Jersey, 16 cities	2.42	1.74	2.26
‡Pennsylvania, 26 cities	1.54	1.63	1.78
Virginia, 8 cities	3.41	1.25	3.20
Texas, 9 cities	4.10	10.06	11.86
Ohio, 21 cities	2.48	1.63	3.12
Indiana, 12 cities	1.49	1.49	1.72
‡Illinois, 18 cities	2.68	2.48	2.60
†Michigan, 11 cities	3.66	2.70	2.56
Wisconsin, 10 cities	2.28	3.40	1.60
Iowa, 10 cities	2.10	4.29	3.98
‡California, 11 cities	2.78	2.06	2.09

A comparative classification of cities with a population of 20,000 or over, according to the amount of the per capita loss into the following fifteen groups, is of interest.

* These cities in this class in two of the three years.
† In this class three successive years.
‡ One city less in 1910.

Per Capita Loss.	No. of Cities. 1910.	1911.	1912.
Less than 25 cents	5	3	3
25 to 49 cents	18	20	21
50 to 74 cents	22	33	23
75 to 99 cents	32	30	28
$1.00 to 1.49	56	53	52
1.50 to 1.99	36	34	43
2.00 to 2.49	34	27	40
2.50 to 2.99	23	20	17
3.00 to 3.49	8	24	16
3.50 to 3.99	13	13	9
4.00 to 4.99	18	10	20
5.00 to 5.99	14	6	11
6.00 to 7.99	12	14	7
8.00 to 9.99	3	4	4
10.00 and more	4	10	8

Relation of Number of Fire Alarms to Population.

There were sixteen cities in which there were more than one fire alarm for every one hundred of population. The city having the greatest number of fire alarms as compared to population was Galveston, Texas, a city of 41,000, in which there was an alarm of fire for every eighty-three of population. Meridian, Miss., with a population of 26,000, came next with an alarm for every eighty-four people. Concord, N. H., a city of 22,000, and Kansas City having a population of 265,000, followed with one alarm for every eighty-six of population. The remaining 286 cities which reported had less than one fire for every one hundred of population.

The city having the least number of fires was Key West, Fla., which has a population of 22,000 and a record of one fire for each 1,151 of population. Hazelton, Penn., a city of 27,000, came next with one fire for each 1,042 people. Pottsville, Penn., a city having a population of 23,000, reported one alarm for every 1,000 of population. All the remaining cities that reported had a record of more than one fire for every 1,000 of population. Only thirteen cities, besides these just mentioned, had a record of less than one fire for every five hundred of population.

All the remainder had a record of one fire for less than every five hundred and more than one hundred of population.

The record of fire alarms in the fifteen cities where a loss of over one million dollars occurred last year, may be seen by consulting the table given on page 28.

A Study of Fires in Foreign Cities.

England. Only one city among the thirteen largest cities had a per capita loss over one dollar. This was Leeds, a city of 445,550 people, with a per capita loss of $1.23. York, a city of 82,297, had a per capita loss of nine cents; and Lancaster, a city of 41,414, had a loss of eleven cents per capita. The average per capita loss of these cities was fifty-four cents, which was one cent more than last year. None of these

Comparative Fire Losses.

	No. of Cities Reporting Loss.			Population.			Per Capita Loss.		
	1910.	1911.	1912.	1910.	1911.	1912.	1910.	1911.	1912.
United States	297	298	300	29,996,723	31,210,084	32,326,633	2.39	2.62	2.55
England	11	12	12	2,335,847	9,898,317	7,164,849	.44	.53	.54
France	8	3	6	4,392,529	3,518,493	4,425,696	.92	.81	.84
Germany	13	8	9	5,616,822	2,306,354	2,659,575	.19	.21	.20
Ireland	2	2	2	657,680	694,272	699,802	.45	.58	.57
Scotland		2	2		484,190	485,091		.56	.49
Italy		6	3		1,373,995	282,082		.31	.90
Russia		2	2		3,483,291	3,485,583		1.17	.84
Austria		1	4		2,031,498	2,658,078		.08	.30
Canada		1	5		125,000	957,372		2.61	2.88
Belgium			1			166,445			.69
Norway			1			250,000			.69
Sweden			1			351,500			.13
Switzerland			1			140,000			.04
The Netherlands			2			417,693			.12
Argentina			1			1,428,042			3.58

	Population.	Total Loss.	Per Capita.
1910—Whole country	91,972,266	*214,003,300	$2.33
297 cities	29,996,723	†71,559,057	2.39
1911—Whole country	93,927,000	*217,004,575	2.31
298 cities	31,210,084	†81,790,877	2.62
1912—Whole country	95,410,503	*206,438,900	2.16
300 cities	32,326,633	†82,297,386	2.55

* Estimated.
† Actual figures reported.

cities had a fire for less than each 1,000 of population, and the average was one fire for every 1,370 people. The average loss per fire was $731. In London, a city of 4,522,961 people, the fire loss was $2,137,220, or a per capita loss of forty-seven cents. There was one alarm for each 1,333 of population. The average loss per fire was $631.

Ireland. Belfast, with a population of 390,000, had a per capita loss of sixty-eight cents; and Dublin, with a population of 309,802, had a per capita loss of forty-three cents. The average per capita loss of these cities was fifty-seven cents, one cent less than last year. The average number of fire alarms was one alarm for every 1,852 of population. The average loss per fire was $1,061.

Scotland. Aberdeen, with a population of 163,891, had a per capita loss of sixty-seven cents; and Edinburgh, with a population of 321,200, had a per capita loss of forty cents. The average per capita loss of these cities was forty-nine cents. The average number of fire alarms was one alarm for every 847 of population. The average loss per fire was $414.

France. The average per capita loss of the six principal cities was eighty-four cents. The average number of fire alarms was one for every 952 of population. The average loss per fire among these cities was $794. In Paris, a city of 2,846,986 population, the aggregate fire loss was $1,412,628, which was a per capita loss of fifty cents. There was one alarm for every 787 of population, and the average loss per fire was $389.

Austria. The average per capita loss of the four principal cities was thirty cents. The average number of fire alarms was one for every 741 of population. The average loss per fire among these cities was $225. In Vienna, a city of 2,064,538, the aggregate fire loss was $378,800, which was a per capita loss of eighteen cents. There was one alarm for every 662 of population, and the average loss per fire was $121.

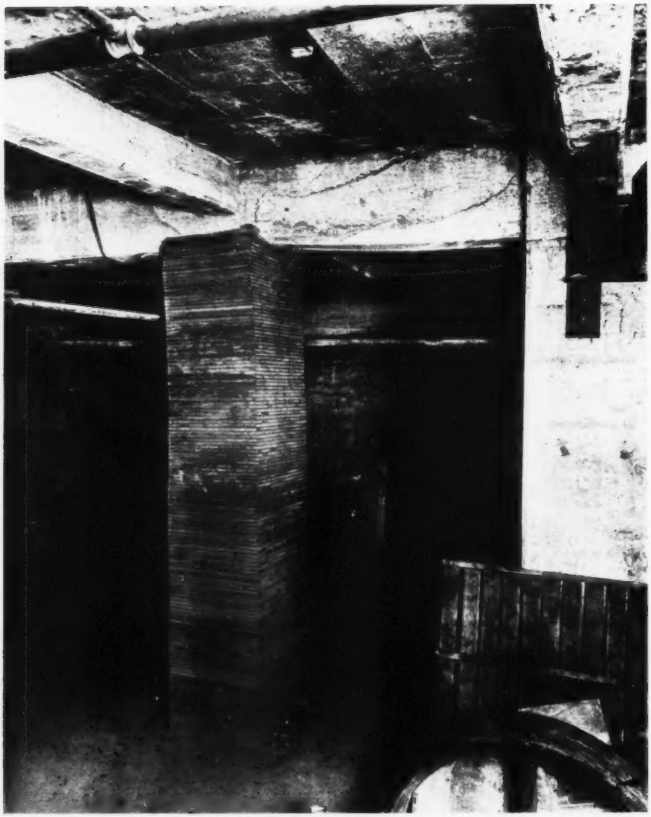
Germany. Among the nine largest cities (except Berlin) Aachen, a city of 160,000 people, had the maximum per capita loss of fifty-seven cents. Dresden, a city of 561,100, had the minimum per capita loss of three cents. The average per capita loss for all of these cities was twenty cents. The greatest number of fire alarms occurred in Hamburg, a city of 990,000, where an alarm occurred for every 599 of population. The least number occurred in Stuttgart, a city of 300,649, where there was one alarm for each 1,961 of population. The average for all cities reporting was one alarm for every 855 of population. The average loss per fire was $175.

Conflagrations Involving Losses Over $500,000 and Occurring in 1912

(From Records of the *Journal of Commerce*)

January	6	Houston, Tex.	Cotton Seed Oil Plant	$625,000
	9	New York City	Equitable Insurance Co. Bldg.	3,000,000
	17	New York City	Terminal Warehouses	1,100,000
February	4	Philadelphia, Pa.	Hensel Collady Co., Millinery Factory and others	1,100,000
	5	Chicago, Ill.	Northern Malting Co., Grain Elevator	600,000
	6	Moline, Ill.	Barnard & Leas Manfg. Co., Flour Mills, etc.	500,000
	21	Houston, Tex.	Cotton Compresses and others	4,500,000
May	7	Providence, R. I.	Revere Rubber Co., Warehouse	575,000
	19	Houston, Tex	Several Business Blocks	625,000
	22	Flint, Mich.	Deaf and Dumb School	600,000
	23	Schenley, Pa.	Schenley Distilling Co., Whiskey Warehouse	800,000
	23	Telluride, Col.	Stamp Mill	500,000
	26	Keasbey, N. J.	Brick and Asphalt Works	940,000
June	18	Ray, Ariz.	Business Portion of Town	500,000
July	2	North Adams, Mass.	Hotel, Theatre and Stores	600,000
August	12	New Iberia, La.	Sugar Plant	500,000
	24	Ronan, Mont.	Business Section	500,000
September	3	Ocean Park, Cal.	Hotel, Casino and Stores	1,125,000
	29	Cleveland, Ohio	Wholesale Grocery House	500,000
October	1	Philadelphia, Pa.	Wharves and Railroad Property	1,000,000
	10	Bayonne, N. J.	Steamers and Oil Works	500,000
	18	Benecia, Cal.	Arsenal	1,000,000
December	11	Cincinnati, Ohio.	Hotel, Department Store and others	780,000
	11	Paterson, N. J.	Department Store and others	580,000
				$23,050,000
		Conflagrations prior to 1912 (since 1866)		1,036,824,135
				$1,159,874,135

NOTE.—Some of these losses are higher than the total losses reported by the Chief of Fire Department for the year.



Photograph from T. B. Sellers (Member N. F. P. A.).

Effect of Expansion of Wood under Water.

A Flood Hazard.

At the time of the recent flood in Dayton a quantity of oak dashes veneered with maple were stacked to within about one inch of a reinforced concrete girder in basement of the Maxwell Motor Car Company's reinforced concrete factory. This girder was 12 x 19 x 24 inches and supported a six-inch reinforced concrete floor.

The accompanying photograph illustrates the enormous power exerted by the expansion of the wood under water. The girder was lifted three inches, together with the concrete floor which it supported. At the present time, ten weeks after the flood, the girder still rests on the dashes, but it has settled about three fourths of an inch. It will no doubt be necessary to make a complete replacement of affected girder and floor.

Fireproof Construction: What it Is and What it Ought to Be.*

By Edward T. Cairns (Member N. F. P. A.).

What fireproof construction is, as we find it to-day, would seem to be merely a question of fact easily ascertained. What it ought to be, I think we will all agree, is implied in the word *fireproof*, and yet a final definition in detail of either proposition depends very much on the viewpoint from which it is regarded.

There are many details which would interest the architect, builder or owner, and which we, too, would find extremely interesting for discussion, but in the limited time available and in order to concentrate our attention on the features which bear particularly on the actual fire resistance as distinguished from some other items which usually go with the type of building, I think it would be well to confine this discussion chiefly to the fire prevention viewpoint.

The architect, builder, owner and insurer, each has his own way of looking at the question, and each has some special interest which may cause him to overrate the importance of some features and underestimate some others.

The architect, of course, wants first of all to please his client in every way and after that if he is an average man he puts in his best effort in making the building attractive to the eye in the matter of materials, proportions, coloring, etc. There are many architects now, however, looming up above the average who are making a very serious study of the real requirements of fire resistance, whose viewpoint is the correct one and to whom we may well look for help in solving the problem from our own insurance viewpoint.

But the builders and engineers who specialize in one kind or the other of fireproof construction? Their viewpoints are very wide apart, and if we may judge by their trade papers and other public statements I am afraid their opinions are sometimes biased by an excess of enthusiasm for their own institutions.

The reinforced concrete man will give many reasons why a hollow-tile building is not fireproof and cannot be, and show you a good many more buildings where tile has failed than where concrete has stood up under fire.

*A paper read before the Insurance Society, New York.

The hollow-tile man will be quite as insistent on the merits of his methods and materials and show examples of concrete buildings which have fallen down in course of construction to distract your attention from the weaknesses of tile as shown in the pictures of Baltimore and San Francisco conflagrations.

As a matter of fact both these types of buildings have their advantages as well as disadvantages, and both ought to be encouraged and improved. The greatest faults in each as built to-day are on lines not peculiar to either but shared by both.

The owner, most interested of all observers, very often takes a very general superficial view and is quite complacent in regarding both building and contents fireproof when the walls, floors and roof are of non-flammable materials. He is not in a position to have a very wide experience with these buildings in fires elsewhere, so may perhaps be pardoned an excessive confidence even to the extent of being willing to go without insurance.

What we really want to know is to what degree are the present buildings and their contents fireproof (we agree, of course, that the term is only relative,—nothing is absolutely fireproof), and what are the details in which the risk is deficient and may be improved, so that buildings and contents may be made more nearly proof against loss by fire.

There are two distinct types of fireproof buildings, each with some variations and some combinations of the two. You are familiar with the type of steel frame tiled floor building so common in New York. Its main supporting frame is of steel members riveted together, and this frame supports the walls of brick, terra cotta or stone, and supports also the floors and roof of hollow tile or concrete, the latter reinforced by some sort of patented metal meshed bars or wire. Its interior walls are generally of hollow tile four to six inches thick, and generally containing more or less wood and glass doors and windows.

In addition to forming the floors, roof and interior partitions, this hollow tile is also arranged to form a complete insulation or envelope about the structural steel frame, the thickness of material about the steel usually varying under the present practice from one to four inches—not four inches of solid material, of course, but a block four inches in total thickness, including the hollow space. This insulation is provided chiefly by the floor blocks themselves, but supplemented by additional pieces for no other purpose than insulation alone.

There are two types of floor arches known as "end" construction and "side" construction, the former being considered preferable. The difference in the two systems is that in the so-called "end" construction all the webs of the block run transverse to the beams, and therefore form a continuous run of material from beam to beam, while in the "side" construction the webs of the blocks run parallel with the beams, and therefore only one half of the webs are in direct compression—that is, in a line from beam to beam. In the usual flat arch construction the "end" style proves the stronger.

The greatest weakness of this tile construction lies in the fact that the individual pieces of tile are in hollow form and having no elasticity, but at the same time, having the quality of expanding under heat, they crack and break apart when one side is subjected to heat. This is usually most apparent on the underside of floor blocks, as you have doubtless seen in photographs of such buildings after a fire. It used to be supposed that this breaking was due to expansion of steam or gases generated inside the blocks. That theory, however, has long since been abandoned and the unequal expansion idea accepted as the explanation. Another weakness is in the large-sized units of the tile which, together with the thin shell, generally not over one inch, makes it difficult to get a good mortar bond between the different pieces, so much so that various forms of metal clips or binders are frequently employed to help in holding the tile in place, particularly about the columns and large girders where the floor arch itself does not lend any stability or support to the insulating portions.

I do not mean to emphasize these weaknesses as condemning the tile construction severely. They are most apparent under rather unusually hot or long-sustained fires, such as the conflagrations in Baltimore and San Francisco. The trouble may be seen to some extent, however, in almost any fire of ordinary severity. In other respects than the steel frame and hollow tile, a building of this type is not radically different from any other large, substantial structure—that is, its trim, decorations, fixtures, etc., are practically the same. Most of them have wood-finished floors, which, of course, contribute some little additional fuel in case of fire.

There are some very interesting features of reinforced concrete, quite different from the type we have just been discussing. The entire walls, floors, columns and roof are of a single monolithic mass of concrete strengthened or reinforced by some style of steel rods or bars, such as the Ransome system with its twisted bars, the Kahn system with its so-called trussed bar, etc.

In all these systems of reinforcement the steel, of whatever shape, is designed to carry practically all the tensile strain while the concrete takes up the compression. As a matter of fact the tensile strength of concrete is considerable, but is so small in proportion to the compressive strength (1 to 6 or 8) that it is ignored in designing. This, of course, necessitates placing the steel members as near as possible to the lower surface of beams and girders and the outside of columns. It is evident then that with steel occupying such an important position in the structure it must be thoroughly protected against heat if the building is to be fireproof —just as essential, in fact, as the protection of the steel frame of any other sort of building.

The relative value of these various styles of reinforcement from a structural point of view regardless of fire resistance is still a subject of discussion among engineers, and there is also still some difference of opinion as to the proper ingredients and method of mixture of concrete, though the latter question has now about come down to a division as be-

tween cinder concrete as advocated by a limited number of designers and almost any sort of stone concrete as preferred by the large majority.

The ideal concrete for building construction above the foundations is a mixture containing a little more than enough Portland cement of standard quality to completely fill all the voids in the sand, and enough of this sand and cement mixture to a little more than fill the voids in the stone, the whole to be tamped down to a solid mass. It is not commonly practicable to follow this formula exactly on account of the difficulty of getting stone and sand of uniform size or of evenly graded sizes, and of accurately measuring them on new buildings. On important contracts where machine mixers are used and the construction is under the superintendence of competent architects, the variation from this rule need not be very serious. However, there is no doubt that in many cases in the past where expert superintendence has been lacking contractors and their employees have wilfully or ignorantly used concrete containing much less than the proper quantity of cement and hurried the mixing so that the result has been a construction neither sufficiently strong nor fireproof. The nature of the material will always allow such abuses and business competition will always prompt some contractors to take advantage of that fact; furthermore, such bad work can be so easily covered up that its detection is almost impossible, except by inspection as it is put in place. Please do not misunderstand this as a condemnation of concrete construction. The art has progressed so rapidly during the last few years that despite the possibilities of bad work, we are actually getting buildings which, in my opinion, are quite as much entitled to be called fireproof as the other type, and are also as serviceable otherwise.

We might dwell at much greater length on the details of both types of building and the materials and methods employed in them. The history of their development is wonderfully interesting, but I sometimes think we may be inclined to spend too much time in details of a sort which are not important from our standpoint, and overlook the items which more directly affect the quality of fire resistance.

In concrete, as well as tile buildings, the interior trimmings, finish, fixtures, and to some extent the exterior decoration, are not at all peculiar, but the same as any other type of buildings, and it is these features which are most affected by fire, and which contribute the chief items of loss on the building itself.

For example, in the old Parker Building, 4th Avenue and 19th Street, which burned January 10, 1908, the total sound value was $562,743, of which 42 per cent was in trim, fixtures and equipment. This was a rather plain loft building of inexpensive type, as compared with the hotel or office building—the value just quoted being about 22 cents per cubic foot. The loss on this building was 65.5 per cent of its value.

In the case of the * Calvert Building in Baltimore, a typical office building, which went through the conflagration, total value was found to

* See report of Commitee on Fireproof Construction of the N. F. P. A. on Baltimore conflagration.

be $634,075, or about 32 cents per cubic foot; 55 per cent was represented by decorations and fixtures. The loss was 57.3 per cent.

The most extreme example of the proportion of destructible and indestructible portions of a fireproof building was Governor Draper's dwelling in Boston, which burned October 5, 1909. This was a beautiful house, said to have cost about $250,000, of which only about $50,000 was fireproof structure, the balance being beautiful panelled wainscoting, stairways, mantels, library, fixtures, etc., of wood and marble. Fire originated in the house and burned it out almost completely, with the result that the building itself suffered a loss of almost 80 per cent, while the contents were practically total.

I mention these cases chiefly to show what the fireproof building itself is, or may become, and the points at which we may look for loss. Let me cite one more, to show, in addition, what the contents of a fireproof building may become.

The office building of the Emerson Brantingham Company, Rockford, Ill., was a three-story, reinforced concrete building, about 60 x 200, modern, and entitled to be classed anywhere as a fine fireproof building, occupied for strictly office purposes—no wood floors. The second story was divided in part into private offices by eight-foot partitions of light woodwork, and the entire floor was fitted up but not at all crowded with the usual wood desks, chairs and filing cases. Fire occurred at night in one end of the second story and burned every burnable thing in the room from end to end, did some superficial damage to the concrete columns, and produced enough heat to warp the ceiling or floor above so that a bad bulge and crack could be seen in the floor of the third story.

The Equitable Building and Asch Building, in New York, I need only mention by name. I could mention a number of other cases of severe loss in so-called fireproof buildings due in every case to peculiar circumstances easily explained after the fire, but not always so clearly seen in advance.

I wish it were possible to tabulate all the other cases, very much more numerous, of course, where fireproof construction has retarded fires from within and without so well that very small loss has resulted to either building or contents. Unfortunately, for this argument, those losses are not widely noticed, and not knowing them we may fail to do full justice to the buildings as a whole. One such case was furnished a few years ago by the Singer Building, when a room on one of the upper floors burned out quite completely before water was applied. In a non-fireproof building a blaze of that dimension and start would have resulted in a very serious if not total loss. The same thing has happened in at least two different hotels in this city, the last case being the new Vanderbilt, where a lot of new furniture burned in a hallway but did not spread to other parts of the house.

Considering these two sorts of cases as typical of the *severe* and *light* losses, what is the difference in conditions which really governed the result? Was it the difference between tile and concrete? Was it a

question of insulation of steel work or dimension of beams or thickness of floors? Not primarily any of these things. It was a question of arrangement of building (except in the Calvert and other Baltimore buildings assailed by conflagration).

I make this statement advisedly and without any intention of minimizing the importance of proper insulation of steel frame. In the Equitable and Parker Buildings the defects in this insulation were undoubtedly a very important factor, but I still maintain that the primary cause of the trouble in these, as well as other cases, was that the building was so arranged as to allow a rapid spread of fire in inflammable contents throughout the building and that if there had been the proper cut-offs from floor to floor the fire would in all probability have been controlled in each case before it reached a point to break down even such insulation as was provided. Does not this condition furnish the answer to the question what fireproof construction should be?

The purpose of buildings of that type, of course, is, primarily, to house valuable goods as well as people in a way so that they shall be safe from fire. It is perfectly plain that no matter how non-combustible the walls, floor, roof and smaller details of a building may be, if it is all one room the contents may be burned just about as easily as though they were in a wooden building. The building itself is generally a minor consideration. The values usually represent less than half, sometimes not more than one-tenth, of the total value of the plant, and the chief consideration should therefore be given to the safety of the contents.

A warehouseman advertising for patrons in his fireproof building calls attention to the fireproof quality, not for the purpose of showing his safe investment, but to convince prospective customers that their goods will be safe in his hands. Likewise, a hotelkeeper appealing to the public for patronage on the ground that his hotel is fireproof does so on the basis that the lives of his guests will be safe. The only way of accomplishing this end is by so dividing the house, both horizontally and vertically, that no large proportion of its contents can be burned out at one time either by internal or external fire. The methods of this division are already familiar to you. The stairs and elevators should be enclosed in fireproof shafts with standard fire doors at each story. The use of wired glass for this purpose, nowadays rather common in some types of building and perhaps in hotels and other places not containing a large quantity of inflammable merchandise, is reasonably safe, but it should not be permitted in large mercantile buildings.

Interior vertical openings are not the only means of spreading fire from floor to floor. There have been many cases in New York and elsewhere of fire traveling from one story to another by means of outside windows; therefore, good shutters or wired glass in metal frame windows is quite essential whether the building be exposed or not, but if exposed at all seriously the windows must be thoroughly protected throughout by wired glass or shutters if the contents of the rooms most directly exposed are to be considered in any sense protected.

There is one other requirement not along structural lines which is as absolutely essential for the safety of the contents of a fireproof building as any other, and should, in fact, be considered part of any fireproof mercantile or manufacturing house; namely, the automatic sprinkler equipment. I say again that no building is fireproof unless it is so arranged and equipped as to make its contents safe, and that cannot be done in cases of mercantile or manufacturing buildings of the areas and heights now required in any other way as surely and successfully as by automatic sprinkler protection. Let us give full credit to the buildings of so-called fireproof construction which we now have. Such buildings as they are contribute very greatly to the safety of our cities from conflagration. With all their faults they are very much less likely to start and spread serious fires than any sort of wooden construction, and I hope these remarks will not be misunderstood as depreciating the value of our present buildings and the rapid improvement made in them during the last ten years, but in order to properly show what fireproof construction ought to be it is necessary to point out its present weaknesses.

The loss of the steamship Titanic suggests several parallels with our own line of thought. The owners of that ship were as confident that it was unsinkable as many of our fireproof building owners are that their houses are fireproof. A false sense of security many times prevents the adoption of precautions which should be taken. The owners of the Iroquois Theatre in Chicago thought they had a fireproof building, and they did have practically that so far as the building was concerned. It was only damaged to the extent of some 13 or 14 per cent, but almost 600 lives were lost in a few minutes, nevertheless, all for the lack of a few comparatively inexpensive fire extinguishing devices, which might, and in fact should, under the law have been provided. They thought it could not catch fire. The owners of the ship thought it could not sink; hence there was no need of enough boats to carry away the passengers. Both learned afterward that certain auxiliary appliances are necessary to supplement the structural features of the building or ship, and both the shipper and building owner now know that so far as structural features go division into small compartments is one of the first essentials. The unsinkable ship, if ever devised, will probably be one in which the compartments are sufficiently numerous and substantially separated from one another that the failure of a few of them will not endanger the whole ship. Likewise the really fireproof building will eventually be found to be the one so divided that the burning out of one part will not ruin the whole.

Without at all impairing their commercial usefulness fireproof buildings may be very much improved and, no doubt, will be in the near future chiefly along these lines:—

1. Subdivision into as many sections, both horizontally and vertically, as the nature of the business will possibly permit.

2. Guarding all exterior door and window openings by wired glass or shutters or both.

3. The more secure covering of all structural steel members whether in tile or concrete buildings.

4. The minimizing of expensive decoration and trim both inside and out.

5. The equipment of most of the buildings with automatic sprinklers.

Photograph by R. O. Dawson.

The Boston Fire Department at Work.

Scuppers Save Water Damage.

The value of scuppers in manufacturing properties, in draining floors in the event of fire and thus saving damage by standing or seeping water, was recently illustrated at a fire in Boston. The stream from the scupper-vent may be seen under the second ladder in the above photograph.

The Panama-Pacific International Exposition.

SAN FRANCISCO—1915.

Fire Prevention and Fire Protection.

By Fire Underwriters' Inspection Bureau (Member N. F. P. A.)

During the early stages of exposition activities, a committee consisting of representatives of the National Board of Fire Underwriters, The Board of Fire Underwriters of the Pacific and The Fire Underwriters' Inspection Bureau held several conferences with Mr. H. D. H. Connick, Director of Works of the Exposition Company. This resulted in the laying out of a fire protection system and the elimination of structural hazards in a more efficient manner than could have been accomplished at any later date. It also resulted in Mr. W. M. Johnson, one of the engineers of the National Board of Fire Underwriters, being given a leave of absence and appointed Chief Engineer of the Department of Water Supplies and Fire Protection for the Exposition, to carry out in detail the work the committee had done in a general way.

General Layout of Site.

The Exposition site is on the Bay of San Francisco in the northwesterly part of the city and comprises 625 acres, with a water frontage of two and one-half miles. The center is level, with slightly rising ground to the east and west, the former being Fort Mason and the latter the Presidio, both Government Military Reservations. The roads have no noticeable grades, as the range of elevation for the entire site is only 80 feet.

The level portion is occupied by the principal Exhibit Palaces; the East by the Concessions (S), and the west by the State (W), Foreign (V) and United States Government buildings (Q), and Stock Exhibits (P), all of which are shown on accompanying map.

As the prevailing winds are westerly, with an occasional high wind from the north, there is little, if any, danger of a fire starting outside the grounds and extending to the Exposition buildings.

The possibility of a conflagration in the grounds is brought to a

minimum by placing the concession district, the most hazardous, to leeward. The State and Foreign buildings, in which it is the intention to allow no exhibits, are well separated, thereby forming but very light exposures. The stock exhibit is beyond them, as are the Government buildings.

A minimum clear space of one hundred and thirty (130) feet is maintained between all buildings, with the exception of points around courts where arches and towers form structural ties between buildings, and these will be of special construction. All interior courts and passages to same have been arranged to give ready access to the fire department.

Construction of Main Exhibit Palaces

Shown on Map as Buildings "A," to "I" (Inclusive), and "K," "L," "M."

Foundations will be on piles or spread footings of wood, according to nature of soil on which they are erected. The building framing, trusses and columns are of wood with exterior walls, carried to the ground, of wood studs covered on the outside by a patent wood sheathing grooved to hold a one-half inch coat of hard plaster.

All cornices, architectural enrichment and ornamentation will be of moulded staff, there being no exterior exposed woodwork other than the flag poles.

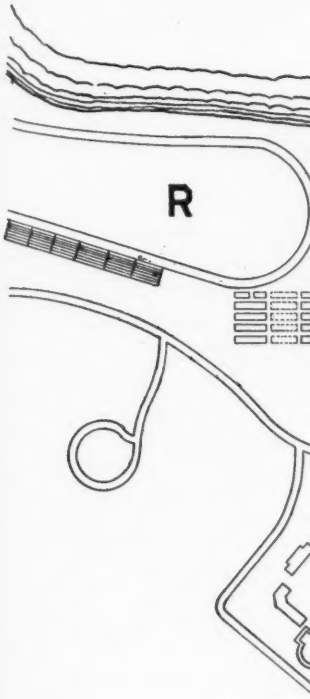
Wherever connecting structures are placed, or where a tower is located between buildings so that the clearance is less than one hundred feet, fire walls of reinforced concrete, or other fire resisting material will be used, or the towers or connecting structures will be of fireproof materials. This applies particularly to the corners of buildings about the three interior courts.

The floors are joisted and covered with two-inch ship-lap plank, except on aisles where an additional one-inch tongue and groove wearing floor will be laid, and with the exception of the Machinery Hall and the Mining Building, will be at an elevation of from four to six feet. This concealed space will be divided into areas, not exceeding 2,500 square feet, by tight partitions of plaster board or sheet metal extending from floor to earth level or by earth walls. Nothing but water pipes and telephone and signal wires will be permitted in this space, and trap doors will be provided for easy access in case of fire.

The inside of the walls will be sheathed to a height of twelve feet from the floor, and all interior woodwork sprayed with a fire-resistive solution

The roof of the Machinery Hall (A) will be from one hundred feet to one hundred and twenty feet from the floor, but in none of the other buildings will it exceed forty-five feet, although the exterior walls, for architectural effect, will be carried to a height of sixty-five feet.

Roofs will be one-inch ship-lap boarding on joists and covered with prepared roofing, consisting of a top sheet of asbestos cemented to a sheet of felt. This will be laid in asphalt pitch over a dry roofing felt tacked



FS 1 Headquarters of Fire Department

FS 2 Fire engine, hose wagon, ladder t

FS 3 Fire engine and hose wagon

FS 4 Fire engine, hose wagon and ladd

Two-way hydrants on high press

High pressure water main

Turret nozzle on roof

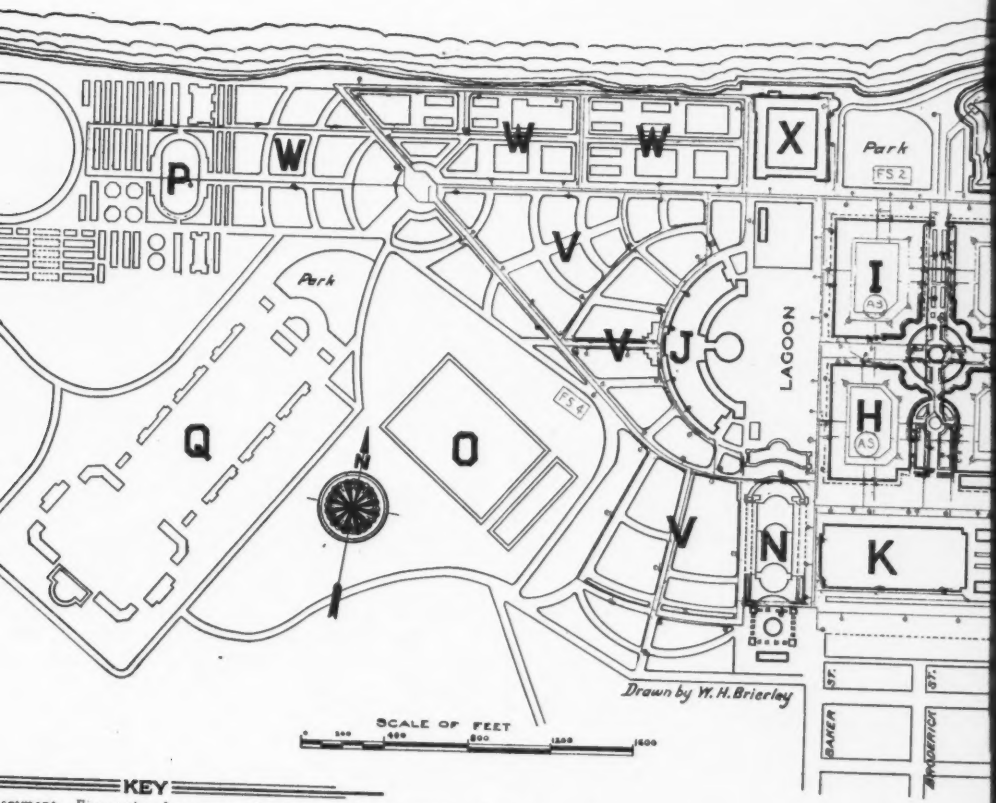
CS Cornice sprinklers

AS Automatic sprinklers

One-way hydrants on service wa

Service water main

Check valve showing direction of



KEY

artment. Fire engine, hose wagon, ladder truck, chief, ambulance and police patrol

ladder truck, salvage corps

on

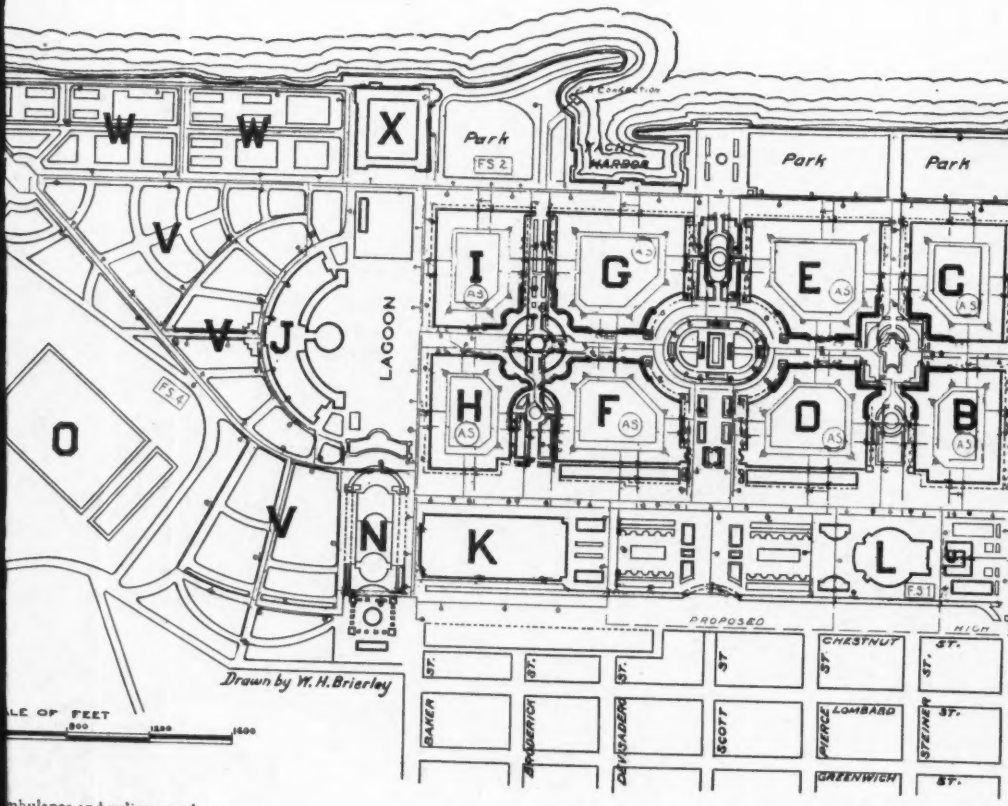
nd ladder truck

gh pressure water main

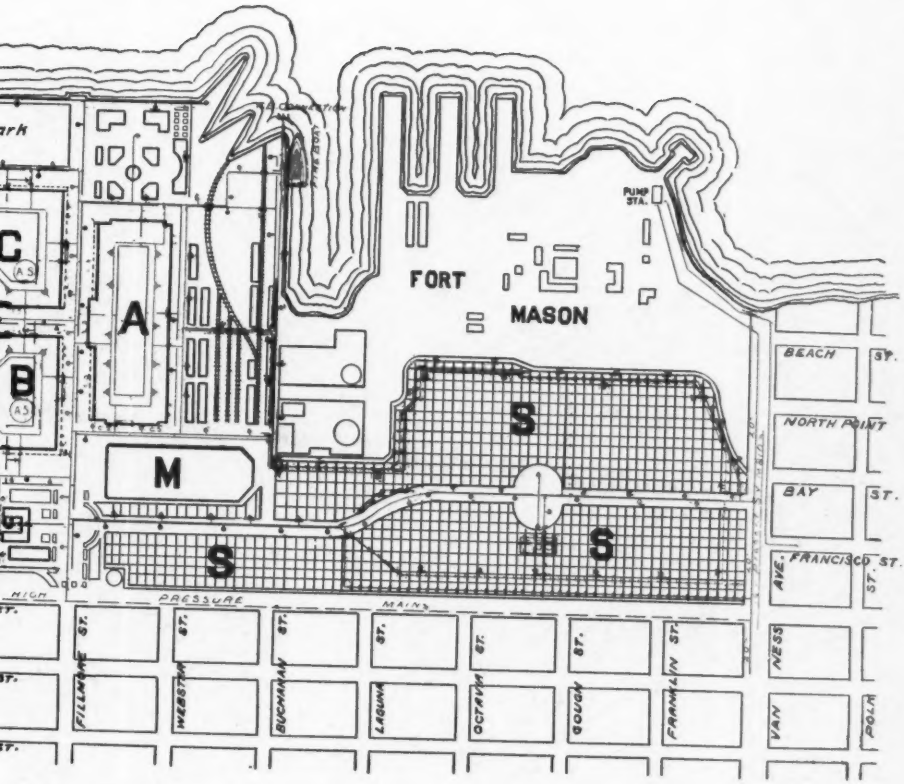
vice water main

tion of flow

Y OF SAN FRANCISCO



mbulance and police patrol


FORT
MASON
PUMP STA.
A
B
C
M
S
S
S
BEACH
NORTH POINT
BAY
FRANCISCO ST.
AVE.
PRESSURE
MAINS
FILLMORE ST.
WEBSTER ST.
BUCHANAN ST.
LAGUNA ST.
OCTAVIA ST.
GOUGH ST.
FRANKLIN ST.
NESS
VAN

to the roof. Roofs will be painted with fire retardant paint. Roof pitches will be very slight, although the monitor sections over centers of buildings will be slightly greater, but in all cases less than one foot to three feet.

Approximately twenty per cent of the roof area will be wired glass skylights. This is a great improvement over previous expositions, in which a cheap substitute has been used for skylights.

All decorations or inflammable materials for inside use will be treated with fire retardant solutions, on which very satisfactory tests have been made.

Building "J" (Fine Arts Building) will be constructed entirely of fireproof materials.

Construction and Fire Prevention Rules.

Rules have been formulated covering the erection of all other buildings. Outside of the Concessions they permit frame buildings with noncombustible roof coverings, and are very strict in regard to the installation of heating and lighting, flooring and fire protection equipments.

All buildings occupied by Concessions (S) will be required to be of brick, stone or reinforced concrete, or covered on the outside with metal lath and plaster, with fire walls parapetted at least two feet, and noncombustible roof coverings. The interiors are to be whitewashed or covered with fire resistive paint, partitions to be of same material as exterior walls, and ceilings to be of metal lath and plaster.

All scenic railways, and other concessions of a flimsy nature, as well as all scenery, will be sprayed with a fire resistive solution. Any concession with a seating capacity of four hundred or over will have to be equipped with automatic sprinklers, not only on the stage but to cover the entire building.

The narrow strip at the west end of the concession district, and lying between the main road and the Automobile Building (M), will be occupied by small booths of such nature as to form little, if any, exposure to the Automobile Building (M).

Gas is the only fuel permitted, and nothing other than gas or electricity will be allowed for lighting, the National Electrical Code governing the matter.

The rules prohibit smoking, open fires, use of locomotives or other boilers, except those using oil fuel, during construction of buildings, and prohibit the use of gasolene or other inflammable oils, dangerous drugs and chemicals, or acetylene.

Fire Marshal rules governing the disposal of rubbish, packing materials and oily waste, and the storage of paints and oils are very rigid.

No work may be done on the grounds without first obtaining a permit, and constant inspection will be made by Inspectors of the Division of Works.

The Fire Underwriters' Inspection Bureau will co-operate with the Exposition Company in enforcing these rules.

In addition, the military guards and watchmen, and the other officers and members of the fire department, will also inspect fire appliances.

Fire Department.

A fire department will be maintained in the grounds, consisting of one hundred men, selected from the San Francisco Fire Department, who will be in command of one of the latter's Battalion Chiefs. This arrangement assures a thoroughly organized fire department to start off with.

There will be four engines and two ladder companies and an auxiliary squad, equipped exclusively with motor operated apparatus. This equipment will be placed in four houses well located in different parts of the grounds. One company will be in service very shortly, and all will be in full force at least six months before the opening.

Seven engine companies, one ladder truck, one chemical engine and one monitor battery, and a total of 92 men of the San Francisco Fire Department are located within 1½ miles of the Exposition.

Water Supplies.

A high pressure water system, as shown on accompanying map, is now being installed. Pressures as high as 325 pounds to the square inch may be obtained. The system is so designed as to deliver 15,000 gallons per minute at the northwest, or most remote point of the grounds. In addition, the fire boats could deliver at least 5,000 gallons. For capacity of supplies, see accompanying map.

Lap-welded steel pipe dipped in asphalt pitch with joints of "Dresser," all steel sleeve couplings and extra heavy cast iron flange fittings is being used. The system as completed will be subjected to a water test of 450 pounds. Numerous gate valves for cutting off sections for alterations and repairs will be installed.

It will be noticed on the map that high pressure mains also circulate inside principal buildings.

This system alone, without the domestic service, will give a water supply for fire protection such as no previous exposition has ever had, and, in fact, such as few cities now have in their high value districts.

In addition there will be, and is now being installed, a service water supply system for domestic purposes, irrigation, and fire protection. Engines can take suction from this system; standpipes with hose attached will be supplied from it, and it will back up the high pressure system on the inside of principal exhibit palaces. Mains will be laid about twenty feet from and parallel to the high pressure system.

A "Booster" pumping engine may be installed to give more pressure and flow. Locations of mains and hydrants on both systems are shown on accompanying map.

In addition to the above water supplies, there will be numerous pools and fountains which will contain approximately 4,000,000 gallons of water. Fire engine suctions will be installed in each of them. Engines can also draw from the bay, at either yacht harbor or ferry slips.

Fire Appliances.

In the principal exhibit palaces the Exposition Company will provide one 3-gallon chemical fire extinguisher to every 3,200 square feet of floor area and each exhibitor will be required to provide an additional extinguisher for each 2,500 square feet of floor area occupied.

Unlined linen fire hose in 75-foot lengths will be attached in sufficient number to allow any portion of the floor area to be reached by one stream. These will be on the service water system, as they are intended for first aid use and in that capacity will be handled by persons with little or no experience of fire apparatus.

Numerous high pressure hydrants without hose attached and for the exclusive use of the fire department will also be installed on the interior of these buildings.

At least one 50-gallon chemical fire extinguisher on wheels will be provided in each building.

Numerous high pressure hydrants will also be placed on the roofs, as will two-inch monitor pipes. The latter will be located at advantageous points to make it possible to reach the fronts of opposite buildings, as well as the roofs of the buildings they are on, and in the case of the Machinery Hall will be arranged to sweep the interior as well. The exteriors of buildings will be equipped with cornice sprinklers in all cases where the exposure is 150-feet or less. In addition to cornice sprinklers shown on map, walls of Machinery Building (A) will also be equipped with them. The water supply will be ample to make these very effective in creating a perfect water curtain.

Again referring to the plan, buildings "B," "C," "D," "E," "F," "G," "H," "I," and probably "M," will be equipped with automatic sprinklers. They will be installed according to standard requirements, which is 8 x 10 feet spacing, staggered. Controlling valves will be located near the floors. Special installations will be required for exhibits where rooms are constructed, or wherever any exhibit obstructs the ceiling sprinklers.

This fire protection will all be in commission as soon as possible after completion of the respective buildings, not waiting for the installation of exhibits.

Fire Alarm Systems and Watchmen's Service.

A system of municipal street fire alarm boxes will be located throughout the grounds on the outside of buildings about 400 feet apart. They will be mounted on pedestals and connected by underground conduit to a fire alarm office in the Service Building, where operators will be on con-

stant duty. A duplicate system will lead from the latter to each engine house, and also to the Central Station of the San Francisco Fire Department. Telephones will be installed in these boxes for communication to various parts of the grounds.

There will be no fire alarm boxes on the inside of buildings, as the latter will be equipped with some form of thermostat, approved by the Underwriters' Laboratories. Thermostats will be connected to the central fire alarm station, as well as to indicators in the several buildings, every portion of which will be covered, including space under floors.

A strictly military organization will be detailed to act as guards and for patrol and watchman duty during the Exposition. This force will be taught the rules and regulations governing fire hazards, sending in of fire alarms and the use of first aid fire apparatus; in addition they will be drilled to assist the fire department.

All buildings and the grounds will be patroled at all times by this force. The night patrols will consist of details of two men, allowing one to turn in the alarm while the other is free to fight the fire.

A large force of detectives, plain clothes men, etc., will be employed for the detection of crooks.

A constant look-out will be kept by two guards from the top of the 400-foot tower, between buildings "D" and "F"; this lookout will have an unobstructed view of the roofs of all buildings and can readily notice any unusual smoke or flame. Telephone connections will be made from this tower to the Central Fire Alarm Station.

Particular attention is called to this guard, as it is believed to be a more efficient scheme than has ever been employed in any previous exposition, being an existing military organization, which will simply have to be moved into the grounds for duty. This should lead to great efficiency and such discipline as could not be obtained in any other way.

The nine buildings, "A" to "I" inclusive, forming the main group, are close together and would ordinarily expose one another. To counteract this, the following precautions have been taken: No exposed exterior woodwork; fire walls of reinforced concrete or metal lath and plaster at points closer than 130 feet; cornice sprinklers forming water curtains; interior automatic sprinklers in all except "A" (the least hazardous and too high to effectively sprinkler); large amount first aid fire apparatus; roof hose and monitors for sweeping adjoining buildings; an excellent system of outside hydrants; a large supply of water under heavy pressure and an excellent patrol system.

A Dawson City Fire Fighter.

Fire Fighting in the Yukon.

By Andrew Hart (Chief of the Dawson City Fire Department).

Dawson City, Yukon territory, Canada, located in latitude 64 degrees, or on a line a little north of Mount McKinley, Alaska, is the distributing center for the Klondike gold mining region, and has a population of some two thousand, with a large migratory population from the mines on completion of the summer mining operations. During the season of navigation, from June to October, it is reached by steamer from Whitehorse, Yukon territory. At other seasons, the only public means of transportation is by six horse stage over the Government road from Whitehorse, which latter place is reached by the Whitehorse and Yukon railway (fare 20 cents a mile) from Skagway, Alaska. Owing to the difficulty of transporting goods in the winter season, it is the practice to stock up the warehouses, which are mainly isolated, during the season of navigation, so as to last throughout the winter.

Coming within the "Land of the Midnight Sun," and with a temperature at times 65 to 70 degrees below zero during the winter, difficulties are presented in fire fighting not experienced by the average department. The unique method adopted to prevent the water supply from

being frozen, the unusual type of uniform worn by the fire department, and some other peculiar local conditions may be interesting to members of the N. F. P. A.

The main avenues of the city are parallel with the Yukon River, and sixty-six feet wide. The cross streets are fifty feet wide, and all have plank sidewalks about eight feet wide. As the frost will heave a brick building, there are only two such, the general construction being of logs, largely sheathed with lumber or iron, or both, there being asbestos paper between the lumber and the iron; in fact, the city ordinances call for all buildings in the business section to be iron clad, except on the front. In the residence section the houses are mainly of logs one story in height and detached; in the business section, the buildings are mainly two stories, some half a dozen three stories, and somewhat congested.

The heating is largely by wood stoves, or what is known as the air-tight wood heater, although there are a number of hot air furnaces with conveying pipes to each room of a building, and a few have steam heat generated on the premises or nearby. On account of the great cost of coal, wood is practically the universal fuel. All stoves, flues and pipes are examined every month by one of the fire department, detailed as an inspector, and many pipes are condemned that are burned and made dangerous by creosote. This can easily be accounted for, as the stoves get red hot. Lighting is practically all by electricity.*

The business section is supplied throughout the year with ample water by a private company. The method is direct pumping from three steam pumps of the condensing type, having a total capacity of 2,500 to 3,000 U. S. gallons per minute, installed in a frame pump house situated 140 feet from the Klondike River.

The suction is to a well 10 feet square in the pump house, and also from a 16-inch pipe to a sump, close to and in direct communication with the river, which runs all winter. The river suction is protected from freezing by a 2-inch exhaust steam heating pipe coiled around same in the river sump and discharging into the river under the ice. The domestic pressure maintained is 60 pounds, which can be increased on alarm of fire to 160 pounds.

The water mains are principally of California redwood, 10, 8, and 6 inches in diameter for hydrant service; 4 inch and 2 inch for domestic service. Steel pipe to the extent of a few hundred feet is also used. All are laid about four feet below the surface. To keep the water in the mains from freezing, it is heated before it leaves the pump house, and there is also a constant circulation by means of a small overflow into the Yukon River at the foot of Albert Street, about half a mile from the pumping station, the three principal mains in First, Second and Third Avenues, uniting near this overflow. The temperature of the water on leaving the pump house is from 42 to 50 degrees F., and in extreme cold weather the temperature of the water discharging at the overflow is

* Electric light plant entirely destroyed by fire since this article was written.—EDITOR.

about ten degrees colder. The method of heating is for the pumps to exhaust into a surface condenser, which is placed in the main suction supply pipe.

The fire hydrants consist simply of 4-inch pipe rising from the main to a T, with two 2½-inch outlets with water gates and hose connections. To prevent freezing, they are heated by an electric collar about 8 inches in diameter and 3 inches wide, passed around the pipe below the T and connected with the main street wiring, the whole being enclosed in a weatherproof box which opens at the top. The temperature inside of these hydrant boxes is maintained at not less than 10 degrees above freezing. A lever wrench is always attached to each hose connection on a hydrant, and the only delay is to turn the water on. There are twenty-three fire hydrants, five of which are close to the territorial government building, their maintenance being paid for by the government. The protection of the eighteen remaining hydrants costs the city $75 a month each, or $13,500 for the ten months in a year the heating is maintained. This includes the cost of the electric collar, and the current for same, and as will be seen averages about $2.50 a day per hydrant,—a large amount.

Before the present method of heating the hydrants was adopted, there was an iron house over each, with a wood stove in same, the fires maintained by an attendant who used a six-dog sled for conveyance.

The fire department consists of one company of eight men, fully paid and on duty at all times. The fire station is two stories, frame, situated in the business section, but partly isolated on the river side, and with only a bank building and the White Pass docks in the block where the fire hall is situated. The station is steam heated throughout and the refuse from horses is burned in the heating furnace.

The department has for apparatus a combined hose wagon (sleigh in winter) with chemical drawn by a team of large horses. These horses are as well trained as in the best departments, and quickly take their places immediately after their stall doors fly open. In reserve, there are a 2-60 gallon Champion chemical, also hook and ladder, drawn by the first horse that reaches the hall after an alarm. In further reserve are three steam fire engines, which would be used to pump from the Yukon River, should any accident happen to the pumping plant or hydrant system.

For uniform, the firemen wear a canvas sheep lined coat with the ordinary fireman's leather helmet with fur earlaps and woolen mittens; these are always on the rig. In the day time the department all wear felt shoes and work in them and have a change always ready. Turn-outs are canvas blanket lined pants, knee-high logger's felts, with rubber shoes laced on them, which are always in readiness beside each man's bed. None of this is discarded at a fire.

The fire alarm system is known as the Autophone; it was first used as a messenger service and has been allowed to stay. It cannot, however, be relied upon, when the temperature is 30 degrees below zero, and a few Gamewell boxes are to be placed this summer. At present nearly all of the alarms come in by telephone.

Previous to the installation of the hydrant system, it was the practice to keep a steam fire engine in a heated house on a scow in the river. That system necessitated very long lines of hose, sometimes two and three thousand feet; but the hose did not freeze in the coldest weather unless the engine was stopped, when the water quickly became solid at the couplings. Fresh hose had then to be laid and the frozen lengths drawn back to the fire hall and thawed out. This was tedious work, as in those days the department lacked a tower. All hose is now quickly dried or thawed in a well arranged tower.

In fighting a fire, the practice is to get the water on as quickly as possible after the required hose has been laid. Should there be necessity for more hose, the driver returns to the hall with one man, and they reload from a reel fixed above. An extra supply of hose is always at hand.

After responding to an alarm in real cold weather, the horses are always blanketed, but seldom have to be kept moving, and during twenty years' experience in fighting fires in temperatures as low as 65 degrees below zero, the writer has never seen the cold so severe as to prevent the use of horses, and does not believe the statement that has been made that in a very low temperature horses cannot be used, as they would suffocate from freezing of the nostrils.

The dryness of the air makes the cold seem less severe than the thermometer indicates. The first frost comes soon after the middle of August, and the cold increases until November. Navigation generally closes early in October. The normal winter temperature is between 10 and 20 degrees below zero, and the real cold during the winter months seldom lasts more than ten or fifteen days at a time, with usually three or four such spells during the winter. When the temperature rises 30 or 40 degrees after a severe cold spell, it feels like the coming of summer. The normal snowfall is seldom over 18 inches; but the past winter has been unusually heavy, some three feet on a level.

The ground is quite generally frozen to a great depth, holes over 200 feet having been dug through the solid frost; but it has been demonstrated in the mining operations that such ground once thawed out will not freeze back to this great depth. The warmth of summer does not thaw out the ground for more than two feet.

The winter climate is more agreeable than that of some cities with a considerably higher average temperature. The main drawback is the shortness of the days. In a way, this is made up by the bright moonlight nights and the light from the aurora borealis, known only in the north land. The summers are continual daylight. From the middle of April to near the end of August, the days are much longer than the nights, while for two months, one can read without artificial light at any time during the twenty-four hours.

The cost of many building materials is high, lumber $50 to $60 per thousand feet at the mill, and nails $8 per keg. Carpenters receive $8 per day.

Good potatoes are raised, while cauliflower, celery, radishes and lettuce are of superior quality.

Electrical Inspection and the National Electrical Code

At a recent meeting of the Kilowatt Club, a Brooklyn organization of the electrical fraternity, papers were contributed by two members of the N. F. P. A.—J. C. Forsyth, Electrical Inspector of the New York Board of Fire Underwriters, and H. S. Wynkoop, Electrical Engineer, Bureau of Electrical Inspection, City of New York. Mr. Forsyth's paper was on the subject of electrical inspections and Mr. Wynkoop's on electrical control by the municipality. An interesting feature of the former was the reading of what Mr. Forsyth claims to be the very first electrical rules issued in the United States. They bear the date *October 19, 1881*, and the imprint of the New York Board of Fire Underwriters. They are sufficiently curious to warrant reproduction, and are as follows:—

The New York Board of Fire Underwriters at a meeting held this day adopted the following standard for Electric Light Wires, Lamps, etc., subject to future additions.

1. Wires to have 50 per cent excess of conductivity above the amount calculated as necessary for the number of lights to be supplied by the wire.

2. Wires to be thoroughly insulated and doubly coated with some approved material.

3. All wires to be securely fastened by some approved non-conducting fastening, and to be placed at least 2½ inches for incandescent lights, and 8 inches for arc lights from each other, and 8 inches from all other wires and from all metal or other conducting substance, and to be placed in a manner to be thoroughly and easily inspected by surveyors.

When it becomes necessary to carry wires through partitions and floors, they must be secured against contact with metal or other conducting substance in a manner approved by the Inspector of the Board.

4. All arc lights must be protected by glass globes enclosed at the bottom to effectually prevent sparks or particles of the carbons from falling from the lamps, and in show windows, mills and other places where there are materials of an inflammable nature, chimneys with spark arrestors shall be placed at the top of the globe. Open lights positively prohibited.

The conducting framework of chandeliers must be insulated and covered the same as wires.

5. Where electricity is conducted into a building (from sources other than the building in which it is used) a shut-off must be placed at the point of entrance to each building, and the supply turned off when the lights are not in use.

Applications for permission to use electric lights must be accompanied with a statement of the number and kind of lamps to be used, the estimate of some known electrician of the quantity of electricity required, and a sample of the wire

(at least three feet in length) to be used with a certificate of said electrician of the carrying capacity of said wire. The applications should also state where the electricity is to be generated, whether the connection will have metallic or ground circuit, and as far as possible give full details of manner in which it is proposed to equip the building.

"This," said Mr. Forsyth, "was the first official set of requirements that were ever put out by any organization.

"On Nov. 29, 1881, the Edison Electric Illuminating Co., of New York, sent to the New York Board a suggested set of rules, and on May 8, 1890, the National Board of Fire Underwriters issued a pamphlet on the subject.

"In 1889 the Underwriters' National Electric Association was formed, and continued as the authority in such matters until March, 1911, when it was transferred to the Electrical Committee of the National Fire Protection Association."

Continuing, Mr. Forsyth said, in part:—

You will thus see that the National Electrical Code has been a growth of nearly twenty-five years. It represents the best thought, not only of the insurance engineers, but also of representatives of many national bodies on the subject of safety in electrical construction.

Electricity as a source of illumination and power is generally regarded as more safe than any other known commercial form of energy, but this feeling of security is, we believe, largely the result of the many safeguards that have been thrown around it.

There are many buildings, both public and private, which carry no insurance, and in which, therefore, the insurance companies would have no right of inspection. There is also the question of the life hazard involved, particularly in places of public assemblage, such as churches, halls, theatres, etc., which the fire insurance companies, as such, cannot take into consideration. In fact for many years the only argument for refusal to insert in the National Electrical Code rules intended to safeguard the life hazard was that the fire insurance companies could not legislate for the safety of life. Hence it became necessary for this and other reasons that the law should step in and complete the work left undone.

The idea of state and municipal regulation of both the fire and life hazard of electric work has grown until it has become recognized as right in thought and in principle that such control is both wise and necessary.

In order to meet the demand for such regulation, the National Electrical Code has gradually been broadened until now, and in the 1913 issue will, in a much greater degree, contain requirements which have to do with the protection of life more than protection of property.

This joint interest was recognized by Mr. Wynkoop, representing the city of New York, and by myself representing the New York Board of Fire Underwriters, many years ago, and in 1908 or 1909 the matter was fully discussed on many occasions, and it was decided that there was a great amount of energy wasted by the duplication of inspections on the part of the city and of the Underwriters in New York City. A trial was accordingly made by the city authorities authorizing one of the inspectors of the New York Board to act in their behalf in a certain territory. The results of this trial were entirely satisfactory, and in December, 1909, an agreement was entered into between the Department of Water Supply, Gas and Electricity and the New York Board of Fire Underwriters, under which the City Department were to accept the inspection work done by the Board and endorse the Board's certificates, thereby legalizing the work on all classes of buildings except public buildings, theatres, churches, halls and other places of public assemblage.

Under this agreement a joint board was organized called the "Advisory Board," consisting of three representatives from City Department and three from the Underwriters, to have general oversight of inspection work, to suggest new rules or amendments to existing rules, and to rule upon all special matters brought before it in the shape of requests for special rulings or exceptions from the existing requirements.

On August 1, 1912, the Suburban Fire Insurance Exchange entered into a similar agreement with the Department of Water Supply, Gas and Electricity, and Mr. Bruen was appointed a member of this Advisory Board, the New York Board relinquishing one of its votes in favor of Mr. Bruen.

During the entire period of the existence of the agreement every ruling which has been given by this Advisory Board has been a unanimous one, and has resulted in a co-operation between the interests represented which could have been obtained in no other way. The agreement has resulted in practically a single inspection, thus eliminating the very unsatisfactory attempts to comply with different interpretations of rules as well as different rules which the two Boards were formerly endeavoring to carry out.

The City Department has in no wise relinquished its authority or control over the situation, and the underwriting departments are carrying out their part of the agreement by enforcing the City Requirements.

At a meeting held in Boston on January 14th and 15th a special committee of the Electrical Committee of the N. F. P. A. considered the variations now existing between the City Electrical Code and the National Electrical Code, and agreed to recognize for adoption a great percentage of the changes in the next issue of the National Electrical Code. We have, therefore, the hope that in the issue of the new 1913 National Electrical Code and the 1913 issue of the New York City Code the differences will be so slight that it will be almost impossible to detect them, and that there will be but few, if any, brackets showing such differences in the next issue of the New York City Code.

We hear a great deal of the inspection departments from a contractor's point of view, as we have poured in upon us day by day the ideas and opinions concerning our efforts from many sources, which if they were one half true would consign us and our work to perpetual oblivion if not to a place much worse than that. It might be well, therefore, to see if we cannot find some advantage to the contractor and to the public which would serve to compensate each of these for all the troubles and expense caused by the enforcement of a set of standard requirements. By the carrying out of reasonable rules, and by the application of proper restrictions, the customer is protected against any unfair advantage which an unscrupulous contractor could take of his ignorance, and insures that the work done will not only fulfill the desire of the purchaser for a while, but will continue to prove reliable for a considerable length of time. That there are some contractors who would take an unfair advantage of their customers nobody will deny.

This protection alone, to the public, would, we believe, warrant all the interference now given by the Inspection Departments.

At the conclusion of the paper by Mr. Forsyth, Mr. Wynkoop discussed the matter of the control of electrical installations by the municipality. Mr. Wynkoop said:—

It is a far cry from the days of the middle eighties, when linemen were roasted to death on poles on Broadway, and every fire that could not be definitely assigned to some other cause was charged against "defective insulation," to the present time when no one questions that the control of electrical activities is a function of the commonwealth, and every municipality is striving to formulate and enforce suitable regulations for the installation of electrical appliances on highways and in buildings.

In an orderly sequence there must first be provided laws imposing the duties

of control upon some public official; then standards of construction must be promulgated; then inspection service must be instituted; and, finally, some plan must be evolved by which, through licensing or otherwise, electrical contractors or workers can be held to proper accountability for their acts.

To recapitulate: we have,—

1st. An ordinance or other enabling act.
2d. A code.
3d. An inspection service.
4th. A license law.

1st. Most municipalities make the mistake of attempting to crowd too much detail into an electrical ordinance. In my opinion the standards of construction have no place therein, because it is often difficult to secure the passage of the ordinance in the first place, and it may subsequently prove to be just as tedious a matter to bring about the enactment of any amendment which may be urgently demanded by the march of electrical progress.

It would be far more satisfactory to state in the ordinance merely that the standards of construction are to be such as may from time to time be promulgated by the responsible authority (Commissioner, City Electrician, Chief Electrical Inspector, or Chief of the Fire Department, as the case may be).

The ordinance should begin by assigning responsible control of electrical matters to some designated city official. It should then provide that no electrical construction might be performed upon a highway without a permit therefor. Another paragraph should state that no electric wiring nor appliances installed in any building might be placed in service without a permit (or certificate). Another paragraph should provide for the promulgation by the responsible party of standards of construction otherwise known as "the code"; and if it be deemed desirable to place a check upon this authority, it might also be provided that the proposed code before promulgation must have received the endorsement of the mayor.

Further, provision should be made for an Advisory Board consisting of at least three persons, one of whom should represent the municipal electrical inspection service, another the local Underwriters' inspection service, with the other or other members to be selected as local conditions determine. Generally speaking, it is unsafe to place the average electrical engineer on such a Board unless he has had some previous experience in fire prevention practice or ideals. In those localities where a reliable contractors' association exists, it would perhaps be desirable that its representative should hold membership on the Board.

It is necessary also that a paragraph should be devoted to suitable penalties for non-compliance with the ordinance or with any rules or regulations made pursuant thereto, and the phraseology of this paragraph must, of course, depend almost entirely upon local conditions.

Finally, electrical construction by other than licensed persons, firms or corporations should be prohibited.

In other words, the ordinance should be merely an enabling act, with suitable restrictions and penalties.

2d. The standards of electrical construction should conform as closely to the National Electrical Code as local laws and conditions will permit. This is in the interest of standardization. It is no longer considered progressive or even smart for any city to adopt a code differing widely from the National Electrical Code. Manufacturers, jobbers and contractors, as well as the inspection departments themselves, suffer unnecessarily not only from these uncalled for differences, but from the mere fact that the form, phraseology and numbering of the National Electrical Code are not retained by the different cities, even though the substance of the requirements is the same in both.

For several years past the city of New York has been printing its code practically in facsimile of the National Electrical Code, indicating throughout the book its specific departures therefrom. One book, therefore—and that the city's edition—serves as the reference medium for our contractors, who through years

of experience with the National Electrical Code know just where to find the particular requirement for which they happen to be looking. And when they find it they know exactly what the National Electrical Code calls for, whether the city accepts the requirement, or what substitute the city is enforcing.

3d. The principles underlying the National Electrical Code, and the methods of enforcing compliance by means of an inspection service have been covered to-night by Mr. Forsyth from the dual standpoint of the city and the Underwriters.

4th. Undoubtedly "angels fear to tread" upon the subject of licensing, but others, no matter how you may characterize them, must "step in" as a matter of civic duty.

Those who object to *any* plan of licensing electrical workers have just two general arguments to advance. They say, in the first place, that this is only another step in the direction of restricting personal liberty, that we are already controlled and licensed nearly to death, and that it is undemocratic, unwise and unfair.

In the second place they point to existing licensing boards—not necessarily electrical—which have fallen under public suspicion, and they express grave fears that the licensing remedy as applied to electricians will, through politics, graft or oppression, be worse than the unchecked and reckless wiring disease.

In the abstract these two objections must be given much weight. Let us consider, however, from the practical side, what the alternative is and how it operates contrary to the public health.

Water, sewer or gas constructions give prompt evidence of their defectiveness, and steps are immediately taken to rectify the errors before serious damage can be done. With electric wiring, however, the defects may remain hidden, or unappreciated, or inactive for days, weeks or months, only to disclose themselves at last by means of some disastrous fire or serious personal injury resulting from electric shock. If, then, licensing of plumbers and steam engineers is deemed essential to the well-being of the community—and this is quite generally recognized to be the fact—the licensing of electrical workers ought to be deemed far more important, partly because the wiring defects are less evident to the senses and partly because there are so very many items of electrical construction that may be classed as defects.

It would appear, then, on the whole that the theoretical objections to licensing must give way before the pressing practical demand for such control over the men who are responsible for electrical construction as will prevent the incompetent and curb the careless or criminally inclined.

Please note that I divide all electrical workers into three classes: the incompetent, such as schoolboys, janitors, bell hangers and their kind; the careless, who handle insulation roughly, nick wires and forget to solder and tape; and the criminally inclined, whose acts clearly demonstrate them to be interested only in having the circuits operative and the certificates issued. Of the criminally inclined I feel that we have comparatively few in New York City, and those few are so bad that they ought to be placed in jail for the remainder of their natural lives!

But if a review of the situation forces upon the thoughtfully minded the necessity for an electricians' license law the subject becomes very cloudy. There are many different interests to be considered, many views to be reconciled, many evils to be guarded against—and the place to conduct these delicate and difficult negotiations is assuredly *neither* the chamber *nor* the committee room of the Board of Aldermen or of the Legislature.

Any proposed legislation should be agreed upon in advance by substantially the entire local electrical fraternity, and should be presented for passage in the exact form which the law is expected to assume. With such support it could hardly fail of passage.

The spirit of co-operation and uplift is in the air; why should not the electrical fraternity concern itself with the improvement of its own personnel and the work performed?

It might be well at this point to enumerate the interests which occur to me at this moment as properly demanding representation in such a conference as I have suggested:—

The municipal electrical inspection service.
The Underwriters' electrical inspection service.
The Electrical Contractors' Associations.
The Electrical Workers' Unions.
The operating companies.
The private plant owners.
Other parties, such as newspapers and factory owners who carry electricians regularly on their payrolls or whose engineers are qualified as electricians.

In my opinion the following points at least should be considered in the construction of a license law:—

It must define clearly what persons are to be licensed.
It must be free from criticism as to class legislation.
The fee must be small and the guaranty bond large.
It must provide for a majority of technical men on the board.
It might preferably apply to the state at large rather than to the municipality, as in this way the greatest uniformity could be secured over the widest territory.
It should provide four kinds of penalty:—
Fine, imprisonment, revocation of license, forfeiture of bond.

The one pre-eminent weakness of electrical control and inspection in this country to-day seems to center in the question of licensing. In very many communities no electrical license law prevails and in others the laws are inoperative or unsatisfactory for one reason or another. In New York State a number of attempts have been made to enact a license law, but each bill has failed because at the last moment some one interest which had not subscribed, or been asked to subscribe, in advance, to the phraseology of the bill, was able to marshal sufficient opposition at the critical moment.

The New York Water System.

(From Fire and Water Engineering.)

The work of bringing water from the Catskill Mountains to New York is progressing with all the speed that can be made with the army of several thousand men employed on the enterprise. Not only are these men at work on the surface, but hundreds of feet under Manhattan Island they are blasting and digging night and day. In the locality where the reservoir is to be made, up in the Catskill district, many square miles of country have been cleared. With a heavy machine, to which is attached a tearing and cutting device, trees and stumps have been uprooted. Thousands of trunks and many cords of gnarled roots have been burned. Old houses have been torn down and fired. Grass and brambles and weeds have been drawn together in piles and burned. There is to be left in the great basin as little organic matter as possible, although with the freshets when the water fills the reservoir a considerable quantity will be borne down into the big tank. A part of the reservoir will be the sides of mountains. One of the greatest reservoirs in the world is the one at Ashokan, which is so soon to go into commission. The daily supply of New York—500,000,000 gallons—could be drawn from it without causing anybody to notice it. The authorization to begin the Catskill water reservoir construction was given in 1907. The main reservoir, 14 miles from Kingston, is now practically completed, and the great aqueduct which is to convey the water to the city is approaching completion. The tunnel under the Hudson has been completed. A large portion of the great water tunnel under New York, hundreds of feet below the surface, cut in rock, is completed as far south as Union Square. The water which is to course through these tunnels is to be gathered from the Esopus Creek watershed, which drains into the great Ashokan reservoir. Using the four drainage areas in the new water system for New York, designed to supplement that of the Croton, it is estimated that, even in the dryest kind of weather, 770,000,000 gallons of water a day can be easily dispensed to the city, more than 127 miles distant.

It is estimated that from the reservoir at the foothills of the Catskills it will take the water three days to reach Staten Island, to which it is the intention to convey water through a continuation of the tunnel. The journey of the water to the Borough of Richmond involves a passage under the Hudson, under mountains and deep below the surface of busy Manhattan, and then under the Narrows. It is estimated that the cost of the Ashokan reservoir, including the expense of relocating highways and

paying for 11 miles of railroad track, is nearly $18,000,000. If all the water which this great repository can hold were turned over Manhattan, it would cover the borough under 28 feet of flood. The whole area of the reservoir is about equal to that of Manhattan from the Battery to 116th Street. Around the reservoir highways are being graded so that the automobilist and the driver can make a complete circuit of the tank and view the shimmering waters. There will be plenty of water to see, for the estimates place the capacity of Ashokan at 132,000,000,000 gallons, resting upon 8,180 acres. This volume of water is held in place by dams and dikes. The main dam, a structure of reinforced concrete and rubble, is 4,650 feet in length, or nearly a mile; 220 feet in height, 190 feet thick at its base, and 23 feet at its top. The maximum length of the great reservoir is three miles and its average width one mile. There is a natural basin at the point where the reservoir is being built, but in order to complete the work 2,960,000 cubic yards of earth and rock were excavated, 8,069,000 cubic yards of embankment set and 984,000 cubic yards of masonry laid. The city has so far bought 1,187,000 barrels of cement to use in the concrete construction. On an average 3,000 men a day have been employed on this gigantic task. Sixty-four miles of highways were discontinued and 40 miles more were built. One of the last big tasks of the enterprise will be the removal of 11 miles of the tracks of the Ulster and Delaware Railroad, which has been diverted in order to give room for the reservoir. The railroad had to build new tracks around the reservoir. Up to the last, however, it has been permitted to send its trains through a gap in the walls.

Color, Paint and Varnish Factories.

By F. E. Roberts (Member N. F. P. A.)

Part III. Varnish Factories.

Introductory.

Some kind of a transparent preservative material or varnish, applied to a painting, has apparently been known for centuries. Paintings from Herculaneum and Pompeii have been unearthed in which the colors appear perfectly bright. The varnish or preservative material was a preparation of wax. Real varnish, however, dates from the discovery of the art of lacquering, in Japan, during the eighth century A. D. Japan lacquer is essentially the juice or sap of a small tree, a natural varnish, and, as prepared and used by the Japanese, gives a lustrous and durable coating, probably not equalled by any other kind of varnish to-day.

Varnishes may be divided into two classes—oleo-resinous and spirit varnishes. The first consists of a drying oil, driers, resins, turpentine, and usually benzine. The second consists of resins dissolved in some volatile solvent. Shellac varnish, often called simply "shellac," is the common representative of the second class. Oleo-resinous varnish is the more important class and the kind most generally meant by the term "varnish" when used without qualification.

Manufacture of Oleo-Resinous Varnish.

Buildings. We often see old buildings, as old dwellings, which should be torn down, converted into "light manufacturing" premises, a purpose for which they are totally unsuited. Frequently there are several occupancies of this nature under one roof—a veritable hive of industry. It is not an uncommon occurrence, however, for the bees to be smoked out. "Light" manufacturing is sometimes a very apt term in more senses than one. It is a pleasing feature of varnish making that any old shack cannot be converted into a varnish factory. On the contrary, special buildings have to be erected, used for that purpose only, and wandering bees must seek hives elsewhere.

Gum Melting and Varnish Boiling Building. This building should be of fire resistive construction throughout, having but one story and no basement, a cement floor, flat roof with standard skylights, and no exposing windows. These buildings are frequently found with wooden roofs and non-standard skylights, and occasionally with windows.

A succession of chimney stacks, or one continuous stack, for the furnaces generally cover one entire side of the building. Sometimes this

Fig. 9.
Varnish Oven and Oil Caldrons.

stack is located in the center of the building with the furnaces on opposite sides.

The furnaces are circular in form, underground, with an underground draught, the mouth being just above the floor. In operation the surface of the burning fuel (coke) is about level with the floor. In one form the stack for the furnace is built out into the room to form a hood (Fig. 9), the very wide flue being directly over the furnace. In another, the hood is thrown out from the face of the stack with a large opening into the flue. One form has a separate "vapor flue" at the back, joining the main flue (which latter is directly over the furnace), part way up. In either case the varnish pot when on the fire sets entirely within the "oven" formed by hood and dividing brick walls from other ovens (Fig. 10). Generally in addition there is a metal hood attached to oven, which can be let down when the pot is drawn off the fire.

Reducing Building. This is usually a shed, with one side open, or with doors only on one side. The description of boiling building should apply to this, omitting the stack, ovens and furnaces, and does apply in a good factory, except that fireproof roofs are still more rare. A fireproof roof is not so important, though desirable. Where the building is a brick or concrete shed with one side open (Fig. 11), giving all the light required, a light, all metal roof is sufficient. It should be well detached from the boiling building, but sometimes adjoins one end. If any attention is paid to proper construction, there will be no communication between these buildings.

Cooling, Settling and Filtering Building. This is a small structure which may adjoin the reducing building, without communication. The

Fig. 10.
Varnish Ovens.

same general description for the other buildings applies to this one. The roof should be of fireproof or first class construction. In some factories this building is omitted entirely.

Fig. 11.
Reducing Building with Ventilating System.

Varnish Storage Building. This should be a detached one-story building of fire resistive construction, with no basement, having a cement floor, and with blank walls against all exposures. Variations from this

type will be found, but in a good establishment it is at least a first class building, having one story, with no basement, and with exposures fairly well protected.

In addition to the above there may also be buildings and sheds for storage of oils, gums, supplies and barrels, and possibly oil tanks. Benzine is generally kept in underground tanks, and in the best establishments turpentine and turpentine substitutes receive like treatment. While in some special cases it may be deemed allowable to store volatile liquids in tanks above ground, the safer way, applicable to all cases, is storage in underground tanks.

Materials. The principal oil employed is linseed, though Tung or Chinese wood oil has been used to some extent for several years. At the present time, owing probably to the very high price of linseed oil, it is largely employed, and is said to be a good varnish oil. There is another oil on the market, expressed from the Soya bean (native of Japan and Manchuria). Driers are some of the solid substances mentioned under paint factories (see QUARTERLY, Vol. 6, No. 3, page 302), and the turpentine substitute is that described as made by distilling pine needles, young twigs and fresh pine wood.

While there is no reason to suppose that linseed oil is purposely adulterated with water by any indirect methods as mentioned under paint factories, yet without such methods it sometimes contains an appreciable amount of water. Water is generally our friend, but in this case it is our enemy, for such oil is liable to foam excessively when heated and "boil over" with a fire as the result.

The resins used are generally called gums in the trade, though properly speaking gums are more or less soluble in water, while resins used in varnish making are insoluble. The principal resins are copal of several varieties, kauri, dammar, sandarac, zanzibar, elemi and rosin. With the exception of rosin all are products of Africa, South America, New Zealand, East Indies, Philippine Islands, and other islands of a tropical or semi-tropical climate. Rosin comes principally from the Southern United States. Amber, which may be used in some expensive varnishes, is found on the shores of the Baltic in Germany.

These resins occur as "fossil resins" buried under more or less earth, as exudations from living trees, and some varieties in both forms, the fossil resins being of higher quality. Copal and kauri form the principal ingredients of any resin mixture for good varnishes while rosin is the chief resin for cheap varnishes.

Processes. There is little machinery required, being confined entirely to pumps and filter presses or separators, with possibly a washing drum for cleaning filter cloths with benzine. The utensils are of a very simple nature.

The process of making varnish may be divided into four parts: melting or "running" the resins; addition of oil and driers and boiling the mixture; reducing or thinning with turpentine and benzine; cooling, filtering, and "ageing" in closed tanks.

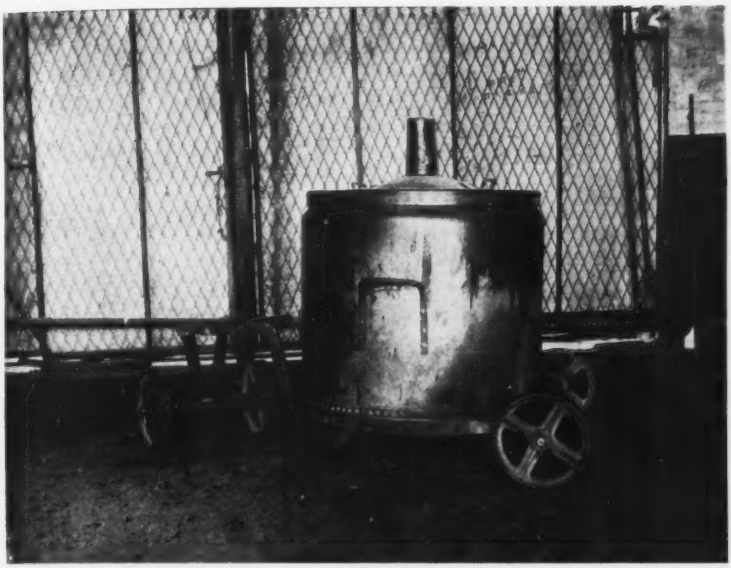


Fig. 12.
Varnish Pot.

The pots (Fig. 12) in which the resins are melted and varnish boiled are of copper, cylindrical in shape, about 40 inches in diameter and 36 inches high, having a capacity of about 150 imperial gallons. The pots rest on iron carriages on wheels, so they can be drawn on and off the fire and transferred to the reducing shed for thinning. Each pot is fitted with a thermometer, an exceedingly necessary feature. There is also a cover with an opening in the top to which can be attached a pipe leading to the "vapor flue" if one is provided; otherwise it is left open. The covers are used only during the "running" of the resin.

The resins have to be heated beyond their melting point, in fact to the point of partial decomposition, in order to be soluble in the oil. This of course produces a vapor which is inflammable. The oil is also heated before being added to the melted resins. sometimes in a fixed iron cauldron, fire heated, similar to those in common use for "trying out" fats. The oil reaches a temperature of perhaps 250°. Driers are added during the process of boiling the varnish or they may be contained in the oil previously treated. The mixture of resins and oil forms only half or even less of the capacity of the pot.

The temperature employed in making varnish depends on the resins used and also on what each varnish maker may deem the proper temperature for the varnish he is making. Probably 650° is about the high

mark. When the varnish maker considers the mixture is sufficiently cooked, the pot is allowed to cool down preparatory to thinning. The whole process of making varnish, including the thinning, can be readily completed within working hours.

Although the mixture is cooled down before thinning it is not exactly cold when ready, for the thinning may be done while the mixture has a temperature of 300°. It is easy to understand, therefore, that copious fumes are given off when the turpentine and benzine are added, even when this is done slowly, with vigorous stirring, and the reducing shed should be so located or arranged that the fumes cannot travel to the furnace fires. In one method of thinning, the turpentine and benzine are pumped from underground tanks to graduated cylinders on the wall only as required for use. From these cylinders the liquid flows slowly by piping, sometimes ending with a rose, to the varnish pots.

In one variation a supply of about two barrels is pumped to elevated tanks outside the building from which it flows to graduated cylinders. The stock tanks containing turpentine may be located at some distance and elevated, from which the flow is directly by gravity to the building or just outside of it, measuring cylinders being dispensed with. Turpentine and benzine may be brought in from an outside supply in containers as required—or a barrel or more of turpentine and benzine brought into the building and contents removed by a hand pump to containers for thinning. The first method is certainly the best from a fire point of view.

The amount of thinning material used, or its composition, depends on the kind of varnish being made and above all on the price. For an average varnish probably the proportions of resin and oil mixture and thinners will be about 60 per cent and 40 per cent, and the thinner perhaps two-thirds turpentine or turpentine substitute and one-third benzine. For a cheap furniture varnish the thinner may consist in part of something resembling turpentine, but it is tolerably certain the varnish will contain as much benzine as it can stand up under and still be a varnish.

After the thinning the varnish is handled entirely by pumps. Sometimes when it is thought to be cold the varnish is pumped from pots in reducing building, directly to storage building. Generally, however, the varnish is pumped into cooling and settling tanks in an adjoining building, afterwards pumped through a filter press to the storage tanks in a building preferably detached. The filter press is the same type used in color manufacture, only in this case the liquid is the product and the sediment the waste. A separator may be used, this being a centrifugal machine similar to a cream separator.

An objectionable variation is to have the settling tanks, filtering press, pumps and storage tanks all in one building. Varnish is very likely to be hot, with accompanying fumes when pumped into settling tank, and there should be no mechanical process carried on in storage building, nor anything but cooled varnish pumped into it. The tanks in storage building are closed and good varnish receives a period of "ageing," which may be a year or even more. Cheap varnish requires

no extended period of "ageing." It is probably incapable of much improvement by that method.

Japans. The process of making the ordinary black "dipping" japan is essentially the same as making varnish. Asphaltum, or asphaltum and coal tar pitch, are the gums, and the thinner is turpentine or benzine, depending directly on the price of the japan. Ordinary open iron cauldrons are used on wheeled carriages as in making varnish. No filtering or "ageing" is required. Stored in tanks similar to varnish. The process is not so exacting as varnish-making, and requires less heat. Reference was also made to japans and driers in Part II of this article published in the January, 1913, issue of the QUARTERLY, Vol. 6, No. 3, page 302.

Hazards.

The principal hazards of resin melting and varnish boiling consist of the ignition of vapors, boiling over, and overheating. The first danger is more apparent in the resin melting, for the vapors are abundant and very inflammable. If they come in contact with furnace fire, through a "back draught" or any other cause, a fire is the result. With the wide flue and good draught usual in varnish factories, fires are not numerous.

Both the resins and mixture of resins and oil are liable to foam excessively and "boil over." Presence of water increases this danger. It is said after the resins are thoroughly incorporated with the oil the danger is much less during subsequent heating. The pots are carefully watched and any tendency to excessive foaming allayed by drawing off the fire and "beating down" the foam.

Possibly there is not a very wide margin between the heat liable to be used and the temperature of ignition of varnish or vapor arising from the same. Whatever the reason may be, the state of the thermometer is an object of the utmost solicitude on the part of the varnish maker, and the danger would appear to be an overheating of a portion of the mixture, with a consequent "caking on" at the bottom of vessel rather than the overheating of the entire mass. As the contents of the pot are stirred frequently this is not liable to occur. In fact the whole process is one of care. Varnish pots on the fire are not left to run themselves.

Varnish making is a trade and one that requires skill and experience, especially up to the thinning stage. Skilled workmen are therefore employed and under their care the danger of heating a highly inflammable mixture is reduced to a minimum. Varnish fires in the gum melting and varnish boiling building are not so numerous as may be thought and it is not impossible to extinguish all such fires at their inception. Where not extinguished in a properly constructed and located building, the loss should be no greater than the contents of one varnish pot, possibly including the vessel itself.

Water is of no use in extinguishing a fire in a varnish pot. Exclusion of the air is the only remedy. This is best accomplished by the cover, aided by wet blankets. Sand is useful for preventing spread of

burning oil and smothering the furnace fire. The liability of a larger loss than one pot of varnish is due to the fact that the pot may be withdrawn from under the hood in an unsuccessful attempt to extinguish a fire. If there is a wooden roof, it may be ignited, and other pots of varnish may also be ignited. It is, therefore, apparent why there should be a fireproof roof, and also why there should be no storage whatever in the building. One or more oil tanks are sometimes found. This is certainly a defect.

With a fireproof building, well detached and without storage, the chance of a large loss in the building itself, or loss by exposure to other buildings is small.

The hazard in varnish thinning is simply that of the fumes igniting at some fire or spark. While the heat of varnish mixture is sufficient to produce copious fumes, it is not sufficient to ignite the fumes. In most instances ignition is caused by unsafe location of the reducing building in reference to the furnace fires of the boiling building. There have been rare cases where there was no fire which could have caused ignition. Probably there was a spark on bottom of kettle. The fumes in a still air would simply overflow from the pot like water, fall down, meet the spark and ignite. With copper pots and coke fires this danger is not imminent. However, one varnish maker claims he looks after this hazard before thinning.

Benzine vapor will travel a considerable distance, ignite from open flames or fire, and flash back to the main supply. This is said to have occurred over distances of from 33 to 40 feet, depending upon the state of the atmosphere and the direction of the air currents. While turpentine vapor is not so insidious, it would probably not be a very safe operation to thin with turpentine within 20 feet of a fire.

If the reducing shed faces the doors of the boiling building, or any opening, it should be 45 to 50 feet from any fire, unless some effective method of ventilation is adopted to carry off the fumes. In one case the reducing shed faces the end of the boiling building, which has a door that may be open. There is a distance of 20 feet between the buildings. Over each pot where thinning is done there is a hood connected with a vapor duct extending along the back of the building, with a suction fan on the outside. There is also a pit, covered by a grating at the front, to which the duct is brought down at one end.

The theory is that any of the heavy fumes which may escape from being drawn up the hood, will collect in the pit and find their way out by way of the extension of the vapor duct. In practice it seems to work perfectly and very little odor is perceptible outside of the shed. In another factory the front of boiling building faces the solid back of reducing building, with a space of from 15 to 20 feet between them, which is satisfactory.

Where the reducing shed adjoins the boiling building at one end, even with no communication between them and the doors of both facing the same way, the arrangement cannot be considered as satisfactory.

While any fumes would have to "turn the corner," so to speak, to get at the furnace fires, yet there is a possibility of their doing so. It may be remarked that no dependence can be placed on doors of boiling building being closed, or fires being out, when thinning is going on, however the buildings are located. If pumps are in the building they may be of the rotary type requiring power. If electric power is used no motor nor connecting wires should be installed here. They should be placed in a small addition with a solid brick wall separating, and with no opening except shaft hole.

An approved system of electric lighting is not objectionable in gum melting and varnish boiling building, but if light is required in the reducing shed it should be only the best system possible of electric lighting for places subject to combustible vapors. This would mean conduit wiring, and fixed vaporproof bulbs, near the ceiling, light turned on from outside. Heat is not required in boiling building and generally reducing shed is too open to allow of it. If heating is desired, only well installed steam or hot water from an outside source should be allowed.

The operations of cooling, pumping and filtering present no especial danger with an approved system of electric lighting, steam or hot water heating. The building or section should be separated from reducing shed by solid fire wall. While a motor may sometimes be found here, it would be better outside located the same manner as recommended for reducing building. A separator for filtering varnish is a very rapid running piece of machinery. It will have at least the frictional dangers always present in such machines, and the filter press is preferable from a fire hazard point of view.

There is an oily rag hazard in discarded filter cloths, and in addition, where apparently expensive filter cloths are used, there is the hazard of washing in an oscillating drum of benzine. Filter cloths that are not too expensive to be burned up every night are much to be preferred.

The reason why the varnish storage building should be of fireproof construction, detached and free as possible from exposure, is mainly because it is here that very large values in proportion to other buildings of plant are assembled. It is necessarily heated either by steam or hot water, preferably from an outside boiler house. If boiler house adjoins, it should be cut off by a solid wall, with no opening by fire door or otherwise. The varnish storage should be protected not only from fire dangers originating in boiler room, but also from any fumes finding their way to furnace fires. The advisability of a one-story building with cement floor, no basement, and cement platforms for varnish tanks, is apparent. It can also be seen that the presence of settling and cooling tanks of hot varnish, and the process of filtering or bringing the pots of varnish, possibly hot, inside of the building for transference to tanks, are objectionable. If a power pump is required it should be steam.

While there is probably no exact chemical union between the thinning material for varnish and the resin-oil combination, yet at ordinary temperatures, even with a cheap varnish, there is probably not so much

vapor given off as would be evolved from the thinners alone, and in a good varnish fumes are not very extensive. When a varnish is hot, however, the combination, if any, is broken up and fumes more or less extensive are given off, depending directly on the kind and amount of thinners used.

Fire Protection.

The gum melting and varnish boiling building should contain six buckets of sand with auxiliary supply of sand in a bin or barrel. There should also be a barrel of water containing woolen blankets or bagging. The reducing building should be provided with similar protection, and the cooling and filtering sections should be provided with pails of sand.

The varnish storage building should contain approved chemical extinguishers and pails of sand.

Automatic Sprinkler and Steam Jet Protection. A sprinkler system is not recommended for melting and boiling, or reducing buildings, and is of doubtful value in cooling and filtering, or varnish storage building. If fire does not originate in a tank or in close proximity thereto, sprinklers will probably be effective, but with a tank of varnish on fire, water might do more harm than good. Steam jet protection is not available for the first named structure, owing to wide open chimney flues. It is advisable for the second, if it can be fairly well closed up, and decidedly of value for the third, which is generally of small area and closed. As to varnish storage it will be effectual if area is not too large. The actual evidence on the subject is contained in a valuable report by Mr. H. A. Fiske of tests made at the Standard Oil Cloth Co.'s works at Athenia, N. J., published in the January, 1910, issue of the QUARTERLY. It was conclusively shown that steam at 90 to 100 pounds pressure, 2-inch supply pipe, with one 1½-inch outlet, extinguished the flames from about 20 gallons of a very inflammable varnish on fire, in less than a minute. Building 15 feet by 22 feet, 16 feet high, containing about 5,000 cubic feet. Door openings closed in usual manner by fire doors. It really seems to be a question of boiler capacity and number of jets (with an adequate supply pipe), as to how large an area can be effectively protected. It is only steam under considerable pressure than can be relied on as a fire extinguisher, probably not less than 60 pounds,—better, 100 pounds or more. Steam under pressure will not mix with air, but drives it away from contact with a burning substance, substituting its own vapor, which will not support combustion.

Department of Fire Record.

By J. Albert Robinson, Superintendent.

Volatile Liquids—Fire Record.

This is a comprehensive study of one thousand fires occurring in manufacturing and mercantile properties, due directly to the hazards of benzine, benzol, gasolene, naphtha, fuel oil, alcohol, kerosene, ether, etc., being a seventeen-year record of the National Fire Protection Association.

Of these fires, 77.1 per cent were due to benzine, 6.5 to alcohol, 4.6 to kerosene, 6.4 to fuel oil, and 5.4 to miscellaneous volatiles. These relative percentages show only the proportion of fires due to the hazards present in the properties involved in the one thousand fires of record. Comparisons of the relative hazards of the volatiles themselves could not be determined without considering other factors, such as the total volume of consumption of each and the relative conditions under which each is used.

Nearly 53 per cent of all fires were due to open flames, matches and static or frictional electricity, open flames leading with 26.7 per cent. There were 33 fires due directly to the presence of watchmen, ignitions being caused chiefly by watchmen's lanterns. In many cases the watchman deliberately did some foolish thing in conjunction with a well-recognized hazard, such as entering dry room of a solvents recovery oven in a hat factory, or lowering his lantern into a tank or barrel containing an inflammable mixture or liquid.

A study of these fires offers a remarkable exposition of the value of automatic sprinklers under conditions of severe hazard and in occupancies that are frequently thought to be unsuited for automatic sprinkler protection. It also demonstrates certain limitations and clearly shows desirable features that are necessary for the best protection.

The number of fires completely extinguished by the sprinklers is better than the general average. The twelve failures were due to the following causes: Defective system or deficient supplies, 5; severe hazard, 2; water spread fire, explosion, water shut off, not determined, and no details, one each.

The sprinklered fires which resulted in no insurance claim amounted to 36.5 per cent, and the large loss fires amounted to 13.1 per cent. The no claim fires for unsprinklered fires only amounted to 6.3 per cent, while the large loss fires equalled 63.5 per cent.

Of the fires extinguished by sprinklers, only 8.4 per cent resulted in large loss, and 44.4 per cent resulted in no claim. Of the fires held in check by sprinklers, 26.2 per cent resulted in large loss, and 24.8 per cent resulted in no claim.

It is noticeable that the average number of heads operating per fire is greater in this record than for the general average. Also that where the fire was held in check, the average number of heads opening was three times the number where the fire was extinguished by the sprinklers. The effect of low water pressure on the number of heads opening is very decided.

An analysis of the efficiency tables also clearly demonstrates the undesirability of dry systems for protection where the fire is apt to result in a quick, hot flash, such as is to be expected in many fires comprising this study. The average number of sprinklers operating in wet systems was 9.15, while 15.77 was the average for dry systems.

Volatile Liquids—Fire Record.

Total Number of Fires, 1000.

Distribution of Fires in Sprinklered and Unsprinklered Properties.

	Sprinklered.		Unsprinklered.		Total.	
	No.	Per Cent.	No.	Per Cent.	No.	Per Cent.
Benzine*	477	47.7	294	29.4	771	77.1
Alcohol	49	4.9	16	1.6	65	6.5
Kerosene	23	2.3	23	2.3	46	4.6
Fuel Oil	37	3.7	27	2.7	64	6.4
Miscellaneous Known	16	1.6	5	5.0	21	2.1
Miscellaneous Indeterminate†	16	1.6	17	1.7	33	3.3
Total	618	61.8	382	38.2	1000	100.0

Relative Distribution of Fires in Unsprinklered Plants.

	No.	Per Cent.
Benzine	294	77.0
Alcohol	16	4.2
Kerosene	23	6.0
Fuel Oil	27	7.1
Miscellaneous Known	5	1.3
Miscellaneous Indeterminate	17	4.4
Total	382	100.0

Relative Distribution of Fires in Sprinklered Plants.

	Sprinklers Operated.		Sprinklers did not Operate.		Total where Sprinklers Present.		Section Unsprinklered.		Total in Sprinklered Plants.	
	No.	Per Cent.	No.	Per Cent.	No.	Per Cent.	No.	Per Cent.	No.	Per Cent.
Benzine	365	77.0	90	78.8	455	77.3	22	73.4	47	77.2
Alcohol	38	8.0	11	9.6	49	8.3	..	..	49	7.9
Kerosene	17	3.5	4	3.6	21	3.6	2	6.7	23	3.7
Fuel Oil	26	5.5	7	6.2	33	5.6	4	13.3	37	6.0
Miscellaneous Known	14	3.0	1	0.9	15	2.6	1	3.3	16	2.6
Miscellaneous Indeterminate	14	3.0	1	0.9	15	2.6	1	3.3	16	2.6
Total	474		114		588		30		618	

* Benzine as a class will include Benzol, Gasolene and Naphtha.

† Miscellaneous Indeterminate may include several of the regular classes, the circumstances being such that the responsible volatile could not be determined.

Distribution of Fires in Sprinklered Plants by Classes.

	Benzine. No. of Fires.	Per Cent Benzine.	Alcohol. No. of Fires.	Per Cent Alcohol.	Remainder. No. of Fires	Per Cent Remainder.	Total. No. of Fires.	Per Cent Total.
Sprinklers Operated	365	76.5	38	77.5	71	77.1	474	77.8
Extinguished without Sprinklers Operating	90	18.9	11	22.5	13	14.2	115	18.3
Unsprinklered Portions	22	4.6	..	..	8	8.7	29	3.9
Total	477		49		92		618	100.0

CLASSIFICATION OF CAUSES.

General Summary.

	No. of Fires.	Per Cent of Known.
Open Flames	240	26.7
Matches	135	15.0
Static or Frictional Electricity	100	11.1
Electric Sparks	62	6.9
Miscellaneous Explosions	60	6.7
Defects in Devices	58	6.5
Careless Use of Devices	54	6.0
Miscellaneous Sparks	44	4.9
Explosions of Lamps, Lanterns and Stoves	42	4.7
Smoking	30	3.3
Automobile Back-firing and Cleaning	29	3.2
Miscellaneous	45	5.0
Total	899	
Cause Indeterminate, not Reported or Unknown	101	
Total	1,000	

Detailed Summary.

Benzine.

	No. of Fires.	Per Cent of Known.
Open Flames	194	28.5
Gas Jets	52	7.7
Gas Stoves	13	1.9
Gas-heated Japan Ovens	6	0.9
Gas-heating Stoves	4	0.6
Gas-heated Soldering Irons	3	0.4
Gas Flames on Various Machines	4	0.6
Kerosene Oil Lamps	20	2.9
Lanterns Used for Lighting	18	2.6
Lanterns Used by Watchmen	17	2.5
Alcohol Lamps	4	0.6

			No. of Fires.	Per Cent of Known.
Candle Light	5	0.7		
Automobile Headlights	2	0.3		
Open Flame Torches	13	2.0		
Heating Systems	21	3.1		
Open Fires	5	0.7		
Miscellaneous Open Flames	7	1.0		
Use of Matches			116	17.0
Careless or Regular Use of Lighted Matches	81	11.9		
Accidentally Ignited	35	5.1		
Electric Sparks			54	8.0
Flying Sparks			39	5.7
Static or Frictional Electricity			99	14.5
Miscellaneous Frictional Heat			2	0.3
Contributory Heat			19	2.8
Gasolene Gas Systems			25	3.7
Back-firing at Automobile Carbureter			22	3.4
Smoking			28	4.1
Automobiles or Engines Cleaned with Benzine			7	1.0
Gasolene Mistaken for Kerosene			6	0.9
Gasolene Torches			20	2.9
Explosions from Uncertain or Unknown Causes			41	6.0
Miscellaneous			8	1.2
Total			680	
Causes Indeterminate, not Reported or Unknown			91	
Total			771	

Alcohol.

			No. of Fires.	Per Cent of Alcohol.
Open Flame			26	40.0
Watchman's Lantern	8	12.3		
Gas Jet	8	12.3		
Lamp	2	3.1		
Lantern	2	3.1		
Open Torch	2	3.1		
Soldering Torch	3	4.6		
Lighted Taper	1	1.5		
Use of Matches			11	17.0
Electric Sparks			5	7.7
Miscellaneous Sparks			4	6.1
Overheating			2	3.1
Lamp Explosions			9	13.8
Miscellaneous Explosions			8	12.3
Total			65	

Kerosene.

	No. of Fires.	Per Cent of Kerosene.
Open Torch	2	4.4
Matches	3	6.5
Lamps Exploded	11	23.9
Lanterns Exploded	10	21.7
Torches Exploded	2	4.4
Lamp, Lantern and Torch Caused Fire	3	6.5
Explosions of Small Cooking Stoves	10	21.7
Miscellaneous	5	10.9
Total	46	

Fuel Oil.

	No. of Fires.	Per Cent of Fuel Oil.
Feed Pipes	30	47.0
Valves	5	7.8
Burners	7	10.8
Valves Opened	2	3.1
Blower Troubles	3	4.7
Starting Troubles	5	7.8
Miscellaneous Escape of Oil	6	9.4
Miscellaneous	6	9.4
Total	64	

Miscellaneous Known.

Materials Involved.

	No. of Fires.	Per Cent.
Ether	9	42.9
Acetone	5	23.8
Carbon Bisulphide	5	23.8
Miscellaneous	2	9.5
Total	21	

General Causes.

	No. of Fires.	Per Cent.
Open Flames	7	41.2
Explosions	6	35.2
Smoking	1	5.9
Electric Spark	1	5.9
Miscellaneous Spark	1	5.9
Miscellaneous	1	5.9
Total	17	
Cause Indeterminate or Unknown	4	
Total	21	

Miscellaneous Indeterminate.

Nature of Fire.

	No. of Fires.	Per Cent
Lacquer Fires	12	36.4
Oil Storage Rooms	4	12.1
Paint Fires	4	12.1
Miscellaneous	13	39.4
Total	33	

General Causes.

	No. of Fires.	Per Cent.
Open Flame	11	40.8
Explosions	5	18.5
Matches	5	18.5
Electric Sparks	2	7.4
Static Electricity	1	3.7
Smoking	1	3.7
Miscellaneous	2	7.4
Total	27	
Unknown	6	
Total	33	

DETAILS OF CAUSES.

Benzine.

Open Lights....194

Gas Jets....52

- Vapor from rubber cement in shoe shops....14
- Cleaning shoes in shoe shop.... 4
- Vapor from naphtha black in shoe shops.... 3
- Viscolizing and waterproofing shoes.... 2
- Miscellaneous vapors in shoe shop.... 2
- Vapor from varnish, japan or asphaltum dipping.... 6
- Vapor from applied japan or asphaltum varnish.... 3
- Vapor from naphtha-thinned paint or varnish.... 3
- Cleaning in printeries.... 3
- Cleaning jewelry.... 2
- Cleaning graining machine in furniture factory.... 2
- Cleaning clothes in tailor shop. Vapors from open pan of naphtha and naphtha-saturated clothes... 2
- Miscellaneous naphtha cleaning.... 3
- Vapors from miscellaneous sources.... 3

Gas Stoves.....13
- Cleaning shoes in shoe shop..... 5
- Receptacles being filled with naphtha..... 3
- Presence or use of asphaltum near stove..... 2
- Can of rubber cement under bench..... 1
- Preparing shoe dressing in laboratory. Naphtha added while mixture was being heated..... 1
- Naphtha-saturated clothes in tailor shop..... 1

Gas heated japan ovens..... 6
- Naphtha-thinned japan ignited from ovens several feet distant..... 4
- Ignition or explosion of vapors in oven..... 2

Gas heating stoves..... 4
- Materials containing naphtha placed too near..... 2
- Automobile being cleaned with gasolene..... 1
- Gasolene tank being filled..... 1

Gas heated soldering irons ignited vapors from rubber cement, coil dip varnish and waste..... 3

Gas flames on various kinds of machines ignited vapors..... 4

Kerosene oil lamps.....20
- Small bench lamps or kit stoves in shoe shops caused naphtha vapors to ignite..... 8
- Vapors from shoe cement ignited..... 2
- Automobile tail and side lights ignited gasolene vapors in garages..... 4
- Vapors from benzine-thinned paint or asphaltum ignited by lighting lamps..... 3
- Gasolene tank on automobile ruptured and vapors ignited from tail light..... 1
- Vapors from miscellaneous sources ignited..... 2

Lanterns used for lighting.....18
- Gasolene being handled with lantern nearby..... 5
- Boys drawing rubber cement in detached cement houses at shoe shops..... 4
- Lanterns lowered into, or held too near, paint, varnish and japan barrels..... 3
- Vapors from miscellaneous sources ignited goldshine brass polish, oilcloth, viscol, japan, varnish and asphaltum 6

Lanterns used by watchmen.....17
- While pursuing his regular rounds the watchman's lantern ignited vapors from the following causes:—partially filled barrel of varnish, empty barrel of japan, leaky japan dip tank, japan storage tanks, varnish storage tanks, benzine furniture filler in open dipping tank, leaky gasolene pump, leak in churn room, explosion in oil factory grinding and mixing room where mills had been cleaned with benzine, 9

While doing something other than making regular rounds watchman's lantern ignited vapors from the following causes:—benzine vapors in oil room ignited while drawing kerosene; drawing gasolene; mixing benzine cement; dipping shovel in varnish tank; dipping fish pole in benzine-thinned stain. 5
Watchman accidentally overturned a can of rubber cement, struck a pail of benzine-thinned varnish with lantern, and fell over a dip tank, breaking his lantern. . . . 3
Alcohol Lamp. . . . 4
Naphtha vapors in shoe shop . . . 3
Soldering a can containing gasolene with an alcoline lamp . . . 1
Candle Light. . . . 5
Workman used candle while drawing varnish. . . . 3
Candle ignited vapors from benzine. . . . 2
Automobile Head Lights ignited gasolene vapors. . . . 2
Use of Torches. . . . 13
Torch used too near gasolene. . . . 4
Vapor from gasolene tanks which were being repaired 3
Open torch in vicinity of japan work. . . . 2
Vapor from gasolene being used for cleaning automobiles ignited. . . . 2
Benzine vapor from paint machine. . . . 1
Soldering break in gasolene pipe line. . . . 1
Heating Systems. . . . 21
Vapors from japan, varnish, naphtha-thinned paint, etc., ignited from boiling furnaces. . . . 7
Vapors ignited from coal stove. . . . 5
Vapors ignited from boilers. . . . 4
Vapors ignited from furnaces. . . . 3
Open furnace ignited vapors in metal workers. . . . 2
Open Fires. . . . 5
Burning material ignited vapors. . . . 3
Bonfires ignited vapors. . . . 2
Miscellaneous. . . . 7
Vapors ignited by an open light. . . . 3
Automatic cigar lighter ignited while filling with benzine . . . 2
Dress cleaned in gasolene taken near a fire. . . . 1
Gasolene vapor ignited by a chemist's safety lamp. . . 1
Explosions from Uncertain or Unknown Causes. . . . 41
Explosion in tank or cans. . . . 9
Explosions occurred in cleaning establishments or rooms, dry rooms or machines . . . 9
Explosions occurred in garages. . . . 5

Grease-extracting tanks or stills exploded..... 4
Explosion in japan room or oven..... 2
Gasolene stoves exploded..... 2
Gasolene tank for heater on collar machine exploded. Burner probably over-supplied 1
Escape of gas from imperfectly constructed devulcanizer..... 1
A new gasolene still in dry cleaning department not properly understood 1
Door of paint storage room opened by watchman, and explosion followed 1
Explosion in varnish impregnating tank..... 1
Explosions occurred in miscellaneous occupancies..... 5

Gasolene Gas Systems.....25
Manufacturing Purposes.....14
Supply pipes broken, or leaked, allowing gasolene gas to escape into room..... 5
Condensation in pipes neglected and ignited..... 2
Gasolene generator exploded..... 2
Explosions occurred from unknown cause..... 2
Back fire from burner to vaporizing tank..... 1
Outlet plug removed for repairs and gasolene gas ignited from nearby forge..... 1
Shut-off valve in supply pipe turned clear out, allowing gasolene to escape and ignite..... 1
Gasolene Lighting.....11
Fire and explosion caused by leaks..... 5
Explosion occurred while filling reservoir or machines that were in operation..... 2
Defects in gasolene lighting systems..... 2
System having inside carbureter took fire while employee was attempting to start it..... 1
Carelessness of porter with unapproved system..... 1

Gasolene Mistaken for Kerosene..... 6
Nightman filled lighted lantern with gasolene by mistake 3
Kerosene oil heater filled with gasolene by mistake. Explosion occurred 2
Lamp filled, while lighted, with naphtha instead of kerosene .. 1

Automobiles or Engines Being Cleaned with Gasolene..... 7

Gasolene Torches.....20
Explosions occurred 8
Leaky or defective torches..... 3
Naphtha liberated from injured torch tanks..... 3
Burner of torch injured or broken by dropping or otherwise... 2
Careless handling of torch. Gasolene spilled on floor or not wiped dry after filling..... 2

Cap to reservoir removed while torch was lighted, to fill or investigate trouble 2

Back Firing at Carbureters of Automobiles 22

Smoking 28

While procuring rubber cement at shoe shop 5
Near dipping, japanning or lacquering tanks 4
Near open cans or pails of gasolene 4
In garage while gasolene was used for cleaning 3
Used for miscellaneous cleaning 3
Near cement or naphtha in shoe shop 2
While drawing gasolene 2
Near tanks in garage 2
In room where naphtha black was being made 1
While fumigating room with gasolene fumigator 1
Vapors in yard of varnish factory ignited 1

Matches 116

Careless or regular use of lighted matches 81

Vapors from cemented material in shoe shops ignited 8
Match lighted while benzine or benzine-thinned material was being handled 7
Careless use of matches around japan tanks 7
Lighted matches thrown on to cemented material in shoe shops 6
Lighted match fell into open receptacle of naphtha or naphtha-thinned material 6
Lighted match used in cement house 4
Match lighted in room containing miscellaneous articles that had been cleaned with gasolene 4
Lighted match near benzine which had been spilled on floor 4
Lighted match in presence of naphtha black 3
Lighted match in presence of open receptacle of naphtha 3
Benzine thrown into toilets or sinks. Match later lighted or thrown into same 3
Vapors in room from gasolene-cleaned goods ignited. 3
Match lighted on dipping tank or benzine container. 3
Careless use of matches in presence of asphaltum paint 3
Vapors from leaking apparatus ignited 3
Match held too closely to viscol and waterproofing material 2
Lighted match ignited naphtha-saturated cleaning waste or rags 2
Lighted match thrown near empty barrels which had contained naphtha-thinned materials 2

Vapors from can of metal polish ignited while man was looking for same 1
Vapors from insufficiently dried naphtha-bleached leather stock ignited 1
Vapors from gasolene pump in garage ignited 1
Vapors from drip pan of gasolene pump in selling station ignited 1
Vapors from leaking rubber cement 1
Vapors in automobile wash room ignited 1
Match lighted underneath automobile 1
Match lighted in cement mixing and rubber compounding room 1
Accidentally ignited by being stepped on, etc. 35
Near dip tanks 7
Gasolene being handled 4
In cement house of shoe shop 3
Benzine on floor 3
In cementing machine or cement 2
Freshly cemented shoes in rack ignited 2
Metal can of rubber cement ignited 2
Naphtha black in shoe shop ignited 2
Where gasolene was being used for cleansing 2
Washing hands in benzine 2
Near tank or can of benzine 2
Last fell, struck match on bench and ignited naphtha vapor 1
Vapors in garage ignited 1
Caused explosion of barrel partly filled with asphaltum 1
Match located under varnishing machine 1
Electric Sparks 54
Breaking of incandescent lamps 15
Lamp broken near dip tanks 4
Portable lamp being used while cleaning automobile with gasolene 4
Portable lamp being used about automobile 2
Lamp broken near gasolene tanks 2
Portable lamp dropped on floor near dip tank 1
Lamp broken in lacquer oven, followed by explosion 1
Lamp broken near gum cementer 1
Sparks from motor ignited vapors from benzine, dip tanks, naphtha mixtures, etc. 9
Defective insulation on extension lamp cords in presence of gasolene 4
Defective insulation on extension lamp cords in presence of gasolene-thinned mixture 2

Sparks from auto ignition apparatus ignited leaky gasolene or that used for cleaning 3
Sparks from ignition apparatus, cross circuits, etc. 3
Blowing out of fuses ignited vapors from naphtha mixtures.... 3
Spark from contact switch ignited gasolene which had been spilled nearby 2
Vapors ignited by sparks from lamp sockets 2
Magneto coil tested near pan of gasolene 1
Motor coil tested while in varnish dip tank 1
Vapors from benzine tank ignited by dynamo 1
Vapors ignited by spark at starting box..... 1
Spark at key socket ignited vapors from open pan of benzine.. 1
Gasolene vapors ignited by spark from short circuit on telephone wires in contact with metal pipe..... 1
Spark from electric heater ignited vapors 1
Miscellaneous short circuits..... 4

Flying Sparks 39
Clash of metal against metal 7
From emery wheel 6
Clash of metal on concrete floors 5
From nails in shoes 4
Burning material 4
From forge 3
Wax tapers 2
From boiler..... 2
Steam hammer 2
From saw..... 1
Foundry 1
Miscellaneous 2

Static or Frictional Electricity 99
Rubber Works.....45
Spreading 26
Churning 8
Cementing 3
Spot proofing 2
Miscellaneous..... 6
Dry cleansing with gasolene 18
Coating machines in oilcloth factory 13
Contributed by belts 5
Benzine or benzine-thinned mixture ignited 4
Induced by paper in varnishing, etc. 3
Benzine cleaning in shoe factories 2
Window shade painting machine 2
Cementing canvas strips in shoe shops 2
Miscellaneous coating processes 2
Brushing machine in picture film renovating 1

Naphtha sizing of silk ribbons 1
Fire occurred in centrifugal dryer used for removing benzol from non-inflammable pyroxylin 1
Miscellaneous Frictional Heat 2
Heat caused by friction of pulley ignited naphtha in spreader.. 1
Barrel of naphtha-thinned varnish drawn across floor..... 1
Contributory Heat 19
Hot iron parts plunged into gasolene or dipping material 4
Gasolene came in contact with hot substances..... 4
Vapors from gasolene being used for various purposes ignited by heat from stove 4
Vapors ignited by hot machinery 3
Benzine added to hot mixtures ignited 3
Mixture containing gasolene being heated..... 1
Miscellaneous 8
Boy ignited benzine on a printing form to burn out thick spots of ink 1
Thought that icicles or snow fell into a tank of sulphuric acid used to extract water from benzine in an oil refinery. Heat generated ignited benzine 1
Valve on a gasolene testing reservoir sprung a leak and gasolene ignited from the burner being tested 1
Spontaneous ignition in paint room containing large open dip tanks 1
Gasolene in coffee urn turned on and failed to ignite. Operator attempted to light the urn and accumulation of gas caused explosion 1
Employee tried to solder a large can with gasolene in it 1
Lamp filled with gasolene overflowed. When lighted it burst into flame 1
Spontaneous ignition of finishing rags caused the ignition of a can of gasolene stain..... 1
Cause Indeterminate, Not Reported, or Unknown.....91
In connection with japan dipping 23
Gasolene used for cleaning 15
Handling gasolene for various purposes, or open pans 13
Occurred in garage, no details 6
While working about an automobile 6
Defective apparatus 5
Explosion of gasolene engine, no details 1
Miscellaneous processes 22

Alcohol.

Matches 11
Lighted matches held at bung hole of barrels..... 2
Match used for light while drawing alcohol or in vicinity of open vessels 4

Match used to light a gas jet, or cigarette carelessly used or brought too near alcohol..... 2
Match on floor stepped upon and ignited vapors..... 2
Lighted match dropped into an alcohol-thinned chocolate-dipping solution 1
Watchman's Lantern 8
Lantern lowered into a barrel or tank of alcohol or alcohol-thinned material 2
Room containing vapors of alcohol entered by watchman, and vapors ignited by lantern 2
Watchman's carelessness 4
Knocked bung out of barrel and set lantern near same.
Spilled alcohol near lanterns.
Vapors from an alcohol reclaimer ignited.
No details.
Open Flame.....18
Gas jet used for heating small water still ignited vapors from open alcohol can.
Alcohol was being distilled in a small copper still when accident in the distilling apparatus allowed alcohol vapors to become ignited by a gas jet.
Door of a solvents' recovery dryer was opened before blower had been shut off. The operation of the blower drew the alcohol vapor from the dryer towards an open gas jet. An explosion immediately occurred.
A small can of marking ink thinned with alcohol was brought too near a gas jet. Vapors were ignited.
Acetylene gas lamp ignited vapors escaping from still.
Open dish of whip button shellac cut with denatured alcohol ignited either from open flame gas jet immediately above it, or by careless use of matches.
Vapors arising from proof sink probably came in contact with open gas flame three and a half feet away, igniting alcohol in sink.
Vapors ignited from Bunsen burner.
Vapors ignited by a kerosene lamp.
Bung flew out of barrel of alcohol and contents spilled onto lighted lantern.
In changing a rubber tube through which an alcohol solution was flowing from one percolating jar to another, some liquid was thrown near a lamp. This ignited and communicated with the liquid in the jar.
Wood alcohol caused an explosion while being drawn by employee who used an open lantern for light.
Lighted taper used while looking into a keg of wood alcohol.
Vats had been coated with an alcohol-thinned varnish when some one passed with an open torch, and an explosion followed.

Can of alcohol ignited from torch.

Still for refining sediment and impure alcohol was being repaired, and was empty except for dregs in bottom. Instead of removing pipe which was leaking, employee tried to solder same with a blow torch which ignited vapors in still. An explosion and fire resulted.

Carelessness at a soldering machine with an open flame ignited alcohol drip used in cutting flux on cans, which had collected in a pan.

An ordinary kerosene oil can containing a quart of alcohol was near stove used to heat a soldering iron. Alcohol vapors were ignited, and an explosion occurred.

Electric Sparks 5

Employee was filling bottles from a cask of whiskey. He used a portable electric light, which caused a spark. This ignited vapors from the whiskey. Head blew out and contents ignited.

One of the stills was leaking, and employee attempted to locate leak with an incandescent lamp on extension cord. In some way vapors were ignited.

Alcohol spilled on floor above and leaked through floor to surrounding woodwork. Spark from electric elevator controller ignited vapors.

Incandescent lamps colored by immersing in fluid containing large percentage of alcohol and amyl-acetate while current was on. Fire caused by a defective lamp, which formed a short circuit through liquid and ignited it.

Short circuit of glow lamp socket set fire to thirty-six jars of alcohol.

Miscellaneous Sparks 4

Workmen were putting new hoops on an empty hogshead, which had previously contained gum and denatured alcohol, when an explosion occurred. A spark caused by one of the wrenches ignited gas inside of hogshead through the open bung hole.

While trimming the wick of a torch a spark fell into an open two-quart can of alcohol, which immediately burst into flame.

Fire originated in building occupied for storage of alcohol in tanks, probably caused by locomotive spark. Drums of alcohol in yard exploded.

Spark from locomotive was blown through window and ignited vapors around that, stiffening machine.

Overheating 2

Employee was making a solution of balsam tolu in alcohol. Balsam was melted over a gas heater, and alcohol added before melting pot was sufficiently cooled.

Heat ignited vapor from open pan of dipping solution containing eighty per cent of wood alcohol, ten per cent of acetone and ten per cent of castor oil.

Lamp Explosions 9

Employee had just filled lamp, and when same was lighted it exploded and ignited supply can, which also exploded.. 1

Employee poured alcohol into torch without extinguishing the flame, and alcohol ignited 2

Employee attempted to fill alcohol lamp while same was lighted, or before it was sufficiently cool. Can of alcohol exploded 2

While filling an alcoline lamp on a McKay stitcher, the lamp and can which were being used exploded. Either lamp was still hot, or there was a spark on wick 2

Painters were using alcohol torch when alcohol ignited and flashed up 1

Soldering was done with alcohol blow torch. Some alcohol ran out onto bench and ignited 1

Miscellaneous Explosions 8

Explosion of barrel of wood alcohol from unknown cause. Supposed to have been carelessness of janitor with match or candle.

Explosion occurred in alcohol refining still.

While an employee was using a small alcohol lamp at his bench the lamp exploded.

Employee was filling a barrel with a composition composed of wax, resin, whiting and fifty per cent wood alcohol. While pouring the last few gallons into barrel an explosion occurred, blowing out end of barrel.

Boy had just drawn gum consisting of clay and shellac thinned with alcohol from barrel, when suddenly head of barrel blew out with loud explosion.

Two workmen were saturating pyroxylin with wood alcohol. An explosion occurred, which killed both workmen.

Alcohol was being drawn from a barrel, when it became ignited and barrel exploded.

Explosion of alcohol. No details.

Kerosene.

Open torch near kerosene oil 2

Match lighted near kerosene oil that had leaked or had been spilled 3

Miscellaneous 5

Kerosene oil used for tempering ignited by hot steel 2

Careless use and handling of kerosene 2

Breakage of kerosene oil pressure system used for lighting 1

Light and Heat.....36
- Lamp exploded while in use..... 9
- Lamp upset and exploded..... 2
- Lamp which had been lighted for four hours was ignited by reason of a defective burner..... 1
- Singeing lamp filled too full, and flame ignited oil on outside of lamp..... 1
- Lantern exploded while in use..... 7
- Lantern tipped over, and was supposed to have gone out, but later exploded..... 1
- Lantern fell and exploded at bottom of deep bin..... 1
- Watchman was filling his lantern when it exploded..... 1
- Explosion of torch while in use..... 1
- Carelessness of man filling a lighted torch..... 1
- Torch used for heating vaporizer of fuel oil, engine exploded.. 1
- Explosion occurred while small portable cooking or heating stoves were in use.....10

Fuel Oil.

Feed Pipes.....30
- Feed pipe broke. Cause not specifically mentioned.....12
- Feed pipe broken, due to careless accident, by reason of pipe being exposed or unprotected..... 5
- Leakage from feed pipe..... 5
- Bursting or explosion of feed pipe..... 4
- Cotton rubber-lined hose connecting portable oil tank with burner gave way..... 1
- Pipe above ground became stopped up, and when repaired some oil overflowed and caught fire..... 1
- Steam pipe to oil feed became plugged with water and caused oil to overflow and ignite..... 1
- Feed pipe was being disconnected when a flash and explosion occurred..... 1

Valves..... 5
- Shut-off valve blew out or gave way..... 2
- Defective shut-off valve at furnace allowed oil to escape and ignite at burner..... 2
- Valve was broken..... 1

Burners..... 7
- Defective or broken burner allowed oil to escape..... 3
- Burner clogged, causing it to operate improperly..... 3
- Burner failed at connection between burner and pipe from oil pumps..... 1

Valves Opened..... 2
- Valves accidentally opened, and allowed oil to come in contact with open flames..... 1

Valve on oil furnace left open, and oil ran onto earth floor. Furnace was lighted, and oil caught fire 1
Blower Troubles 3
Neglect of a pipe feeder to close the valve on the air line after having cleaned it 1
Accumulation of fuel oil in furnace when air was shut off 1
Oil escaped from pipes while changing from steam to air blast 1
Starting Troubles 5
Burners opened too wide 2
Supply pump started before proper ignition at burners took place 2
Intermittent operation of the automatic feed after starting caused fire 1
Miscellaneous Escape of Oil 6
Fuel oil escaped and ignited. Defective fittings, etc. 2
Receiver filled too full of fuel oil, and it was forced into air pipes when pressure was applied 1
Man did not remove cover while filling fuel oil tank, which was over furnace. Oil ran down outside of furnace and ignited 1
Accumulation of fuel oil gas caused explosion when attempt was made to light fire under boilers 1
Fuel oil collected with water in small pit under tempering furnace. Explosion occurred when furnace was dumped 1
Miscellaneous 6
Spark from torch fell into tank of fuel oil 1
Barrel of fuel oil ignited from a lighted torch while a can was being filled from barrel 1
Burning oily waste being used to locate leaks in a fuel oil pipe. An explosion occurred, killing one man and seriously injuring another 1
Tank of fuel oil which was being heated exploded 1
Hot rivet fell into oil leakage around pump at base of tank 1
Plug in fuel oil system removed. Oil shot out, and was ignited by torch 1

Miscellaneous Known.

Ether 9
Ether from broken bottles or spilled, ignited by open gas flames 4
Bottle of ether burst while being heated by steam and vapors ignited by gas jet 2
Bottle of ether placed too near gas jet 1
Flash fire resulted from vapor when ether still cover was removed 1

Bottle of ether thought to have been ignited by employee smoking 1

Acetone 5

Explosion of acetone still 3

Fumes from steam-heated kettle holding gums dissolved in acetone, ignited by gas burner six feet distant 1

Violent explosion occurred in the manufacture of lacquer while employee was feeding soluble cotton into 200-gallon drum of solvent acetone. Employee was killed 1

Carbon Bisulphide 5

Fire originated in several small open vessels containing carbon bisulphide for fumigation 1

Dipping can being filled with carbon bisulphide. Contents ignited from unknown cause 1

Explosion of carbon bisulphide from unknown cause 1

Can of carbon bisulphide opened near a gas stove 1

Vapors of carbon bisulphide in basement ignited by spark 1

Miscellaneous 2

Amyl-acetate in vapors of room where scrap celluloid was dissolved, ignited by a spark from an electric short circuit in defective union box 1

Bottle of benzoin burst and vapors ignited from coal stove 1

Miscellaneous Indeterminate.

Lacquer Fires 12

Vapors from lacquer ignited by open flames 6

Vapors ignited from unknown cause 2

Vapors ignited by matches 2

Vapors ignited by electric short circuit 1

Vapors ignited by static electricity 1

Oil Storage Rooms 4

Vapors ignited from unknown cause 2

Vapors ignited from watchman's lantern 1

Match lighted in oil room, and explosion occurred 1

Paint Fires 4

Contents of paint tank ignited while employee was looking for the faucet with a lighted match 1

Man was smoking while drawing paint from a barrel 1

Watchman changed position of a leaking barrel of paint. Paint was splashed on lantern, and a flash occurred 1

Spontaneous ignition of oily material caused a barrel of paint thinner to explode 1

Miscellaneous 13

Explosion of vapor in artificial leather coating machine 2

Explosion of a barrel of brush cement 1

Lighted candle held too near filler cement..... 1
Static charge of electricity ignited vapors from turpentine..... 1
Vapors from a broken bottle of Hoffman's anodyne ignited from gas jet..... 1
Vapors from pan of deodorized tincture of opium ignited from gas stove..... 1
While filling a small can with disinfectant, a match was lighted and vapors ignited..... 1
A defective electric light cord was lowered into a tank of hydrocarbon oil. A short circuit caused slight explosion... 1
A can of brass polish, which was upset, ignited in some unknown way..... 1
While employee was drawing a tar oil from a barrel, an explosion occurred from unknown cause..... 1
An explosion of alcohol and benzine occurred from overheated gas plate..... 1
An explosion occurred when a kettle was heated that contained tar and distillate remaining from the previous day's boiling..... 1

ANALYSIS OF LOSSES.

Detail of Losses as Compared to Class Causes.

BENZINE.

Losses as Compared to Sprinklered and Unsprinklered.

	Sprinklered.		Unsprinklered.		Total.	
	No. of Fires.	Per Cent of Sprinklered.	No. of Fires.	Per Cent of Unsprinklered.	No. of Fires.	Per Cent of Total.
No Claim	135	37.0	18	6.0	153	22.9
Small	178	48.8	95	31.4	273	41.0
Large	52	14.2	189	62.6	241	36.1
	365		302		667	
No Heads Opened	90		..		90	
No data	..		..		14	
Total	455		316		771	

Relation Between Effect of Sprinklers and Losses.

	Extinguished.		Held in Check.		Unsatisfactory	
	No. of Fires.	Per Cent of Extinguished.	No. of Fires.	Per Cent of Held in Check.	No. of Fires.	Per Cent of Unsatisfactory.
No Claim	103	44.0	32	26.4	..	..
Small	115	49.2	60	49.6	3	30
Large	16	6.8	29	24.0	7	70
Total	234		121		10	

ALCOHOL.

Losses as Compared to Sprinklered and Unsprinklered.

	Sprinklered. No. of Fires.	Sprinklered. Per Cent of Sprinklered.	Unsprinklered. No. of Fires.	Unsprinklered. Per Cent of Unsprinklered.	Total. No. of Fires.	Total. Per Cent of Total.
No Claim	15	39.5	..	..	15	27.8
Small	15	39.5	6	37.5	21	38.8
Large	8	21.0	10	62.5	18	33.4
	38		16		54	
No Heads Opened	11		..		11	
Total	49		16		65	

Relation Between Effect of Sprinklers and Losses.

	Extinguished. No. of Fires.	Extinguished. Per Cent of Extinguished.	Held in Check. No. of Fires.	Held in Check. Per Cent of Held in Check.
No Claim	13	43.2	2	25.0
Small	13	43.2	2	25.0
Large	4	13.6	4	50.0
Total	30		8	

REMAINDER.

Losses as Compared to Sprinklered and Unsprinklered.

	Sprinklered No. of Fires.	Sprinklered Per Cent of Sprinklered.	Unsprinklered. No. of Fires.	Unsprinklered. Per Cent of Unsprinklered.	Total. No. of Fires.	Total. Per Cent of Total.
No Claim	25	35.3	7	8.9	32	21.4
Small	31	43.6	19	24.0	50	33.3
Large	15	21.1	53	67.1	68	45.3
	71		79		150	
No Heads Opened	14		..		14	
Total	85		79		164	

Relation Between Effect of Sprinklers and Losses.

	Extinguished. No. of Fires.	Extinguished. Per Cent of Extinguished.	Held in Check. No. of Fires.	Held in Check. Per Cent of Held in Check.	Unsatisfactory. No. of Fires.	Unsatisfactory. Per Cent of Unsatisfactory.
No Claim	21	47.7	4	16.0	..	..
Small	17	38.7	14	56.0	..	..
Large	6	13.6	7	28.0	2	100.0
Total	44		25		2	

Losses as Compared to Sprinklered and Unsprinklered.

	Sprinklered.		Unsprinklered.		Total.	
	No. of Fires.	Per Cent of Sprinklered.	No. of Fires.	Per Cent of Unsprinklered.	No. of Fires.	Per Cent of Total.
No Claim	215	36.5	25	6.3	240	24.3
Small	296	50.4	120	30.2	416	42.3
Large	77	13.1	253	63.5	330	33.4
	588		398		986	
No data	..		14		14	
Total	588		412		1000	

Relation Between Effect of Sprinklers and Losses.

	Extinguished.		Held in Check.		Unsatisfactory.	
	No. of Fires.	Per Cent of Extinguished.	No. of Fires.	Per Cent of Held in Check.	No. of Fires.	Per Cent of Unsatisfactory.
No Claim	137	44.4	38	24.8	..	..
Small	146	47.2	75	49.0	3	25.
Large	26	8.4	40	26.2	9	75.
Total	309		153		12	

Sprinklered Losses as Compared to Class Causes.

	Benzine.		Alcohol.		Remainder.		Total.	
	No. of Fires.	Per Cent of Benzine.	No. of Fires.	Per Cent of Alcohol.	No. of Fires.	Per Cent of Remainder.	No. of Fires.	Per Cent of Sprinklered.
No Claim	135	37.0	15	39.5	25	35.2	175	36.9
Small	178	48.8	15	39.5	31	43.7	224	47.3
Large	52	14.2	8	21.0	15	21.1	75	15.8
Total	365		38		71		474	

Unsprinklered Losses as Compared to Class Causes.

	Benzine.		Alcohol.		Remainder.		Total.	
	No. of Fires.	Per Cent of Benzine.	No. of Fires.	Per Cent of Alcohol.	No. of Fires.	Per Cent of Remainder.	No. of Fires.	Per Cent of Unsprinklered.
No Claim	18	6.0	..	..	7	8.8	25	6.3
Small	95	31.5	6	37.5	19	24.0	120	30.2
Large	189	62.5	10	62.5	53	67.2	252	63.5
Totals	302		16		79		397	

Comparison of Losses in Cases Where Sprinklers Did Not Operate.

	Benzine.		Alcohol.		Remainder.		Total.	
	No. of Fires.	Per Cent of Benzine.	No. of Fires.	Per Cent of Alcohol.	No. of Fires.	Per Cent of Remainder.	No. of Fires.	Per Cent of Total.
No Claim	31	34.5	6	54.6	3	23	40	35.1
Small	57	63.3	5	45.4	10	77	72	63.2
Large	2*	2.2	..	..	..	..	2	1.7
Total	90		11		13		114	

* Sprinklers were shut off.

DISTRIBUTION OF LOSSES IN BENZINE GROUP.

Under Sprinkler Protection.

	Extinguished.		Held in Check.		No Sprinklers Opened.		Total.	
	No. of Losses.	Per Cent of Extinguished.	No. of Losses.	Per Cent of Held in Check.	No. of Losses.	Per Cent of Unopened.	No. of Losses.	Per Cent of Total.
$25 and less	3	2.7	..	..	6	10.9	9	3.9
$26 to $50	11	10.1	5	7.4	15	27.3	31	13.3
$51 to $100	16	14.7	5	7.4	20	36.4	41	17.7
$101 to $200	23	21.2	8	11.8	7	12.7	38	16.4
$201 to $500	26	23.9	11	16.2	4	7.3	41	17.7
$501 to $1,000	14	12.8	12	17.6	1	1.8	27	11.6
$1,001 to $2,000	7	6.4	9	13.2	1	1.8	17	7.3
$2,001 to $5,000	6	5.5	9	13.2	..	..	15	6.5
$5,001 to $10,000	2	1.8	2	2.9	..	..	4	1.7
$10,001 to $25,000	..	..	6	8.8	..	..	6	2.6
Over $25,000	1	0.9	1	1.5	1	1.8	3	1.3
Total	109		68		55		232	

RELATION OF THE DISTRIBUTION OF LOSSES IN BENZINE GROUP.

Between Sprinklered and Unsprinklered.

	Sprinklered.		Unsprinklered.	
	No. of Fires.	Per Cent of Sprinklered.	No. of Fires.	Per Cent of Unsprinklered.
$25 and less	9	3.9	3	1.6
$26 to $50	31	13.3	8	4.4
$51 to $100	41	17.7	7	3.8
$101 to $200	42	16.4	3	1.6
$201 to $500	38	17.7	20	11.0
$501 to $1,000	27	11.6	15	8.3
$1,001 to $2,000	17	7.3	28	15.4
$2,001 to $5,000	15	6.5	25	13.8
$5,001 to $10,000	4	1.7	31	17.0
$10,001 to $25,000	6	2.6	20	11.0
Over $25,000	3	1.3	22	12.1
Total	236		182	

AVERAGE LOSSES.

Benzine Fires.

No Sprinklers Opened.

Average Small Loss	$75
One Loss	1,876
One Loss	26,000

Sprinklers Extinguished Fires.		
Average Small Loss	$273	
Average Large Loss	3,143	
Average Loss for these Cases	672	
One Large Loss not Included Above	57,738	
Average Loss for all Cases	1,195	
Sprinklers Held Fire in Check.		
Average Small Loss	$390	
Average Large Loss	7,135	
Average Loss for all Cases	3,068	
General Average Satisfactory Fires		$1,915
Fires in Unsprinklered Properties.		
Average Small Loss	$356	
Average Large Loss	20,285	
Average Loss for all Cases	14,153	

Alcohol Fires.

Extinguished by Sprinklers.	
Average Small Loss	$366
Average Large Loss	2,086
Average Loss for all Cases	735
Fires in Unsprinklered Properties.	
Average Small Loss	$314
Average Large Loss	28,424
Average Loss for all Cases	20,225

CLASSIFICATION OF BENZINE FIRES ACCORDING TO OCCUPANCY.

	No. of Fires.	Per Cent of Benzine.
Shoe Shops	135	17.5
Metal Workers	89	11.5
Garages	77	10.0
Rubber Works	69	9.0
Dry Cleaning Establishments (including naphtha cleansing in tailor shops, etc.)	55	7.1
Automobile and Bicycle Factories	37	4.8
Carriage and Agricultural Implement Plants	27	3.5
Furniture Factories	26	3.4
Oilcloth and Window Shade Factories	24	3.1
Printing and Lithographing	21	2.7
Electrical Appliances	19	2.5
Paint and Varnish Works	18	2.3
Machine Shops	16	2.1
Patent Leather Works	11	1.4
Mercantile	11	1.4
Woodworkers	10	1.3
Steam Laundries	7	1.0
Textile Mills	6	0.8
Miscellaneous Numerous Occupancies	113	14.6

Brief Analysis of These Classifications.

	No. of Fires.	Per Cent of Class.
Shoe Shops.		
Distribution of Fires.		
Sprinklered	106	78.5
Unsprinklered	29	21.5
Total	135	
Effect of Sprinklers.		
Practically extinguished fire	48	45.3
Held fire in check	9	8.5
No sprinklers operated	49	46.2
Total	106	
Losses.		
No claim	39	29.0
Loss $100 or less	57	42.2
Loss $101 to $500	25	18.5
Loss $501 to $1,000	4	3.0
Loss $1,001 to $1,500	5	3.7
Loss $2,500	1	0.7
Large losses (only one sprinklered)	4	3.0
Processes Responsible for Fires.		
Cementing	54	40.0
Cement house fires	16	12.0
Cork filler	6	4.4
Naphtha cleaning	20	15.0
Naphtha blacking	17	12.5
Oilproofing	5	3.7
Miscellaneous	10	7.5
Metal Workers.		
Distribution of Fires.		
Sprinklered	65	73.0
Unsprinklered	24	27.0
Total	89	
Effect of Sprinklers.		
Practically extinguished fire	35	54.0
Held fire in check	20	31.0
Unsatisfactory	1	1.5
No sprinklers operated	9	14.0
Total	65	
Processes Principally Responsible for Fires.		
Japanning, etc.	50	77.0
Dipping ... 36		
Ovens, painting rooms, etc. ... 14		
Naphtha Cleaning	7	11.0

Garages.		
Distribution of Fires.		
Sprinklered	10	13.0
Unsprinklered	67	87.0
Total	77	
Effect of Sprinklers.		
Practically extinguished fire	5	50.0
Held fire in check	1	10.0
No sprinklers operated	4	40.0
Total	10	
Processes Principally Responsible for Fires.		
Gasolene cleaning	18	23.5
Occurred while making repairs or working about cars	16	21.0
Backfiring of automobile	15	19.5
While filling gasolene tanks	13	17.0
Rubber Works.		
Distribution of Fires.		
Sprinklered	52	75.0
Unsprinklered	17	25.0
Total	69	
Effect of Sprinklers.		
Practically extinguished fire	20	38.5
Held fire in check	20	38.5
Unsatisfactory	3	6.0
No sprinklers operated	9	17.0
Total	52	
Processes Principally Responsible for Fires.		
Spreading	27	39.0
Churning	14	20.0
Cementing	5	7.0
Naphtha cleaning	5	7.0
Dry Cleaning Establishments (including naphtha cleansing in tailor shops, etc.)		
Distribution of Fires.		
Sprinklered	10	18.0
Unsprinklered	45	82.0
Total	55	
Effect of Sprinklers.		
Practically extinguished fire	3	30.0
Held fire in check	5	50.0
No sprinklers operated	2	20.0
Total	10	

Processes Principally Responsible for Fires.		
Static electricity in goods	16	29.0
Vapors from cleansed garments	8	14.5
Explosion or ignition of open pans or tanks of gasolene	10	18.0
Automobile and Bicycle Factories.		
Distribution of Fires.		
Sprinklered	25	67.5
Unsprinklered	12	32.5
Total	37	
Effect of Sprinklers.		
Practically extinguished fire	14	56.0
Held fire in check	5	20.0
No sprinklers operated	6	24.0
Total	25	
Processes Principally Responsible for Fires.		
Handling and presence of gasolene and tanks	15	40.5
In connection with engine testing	8	21.5
Gasolene cleaning	7	19.0
Carriage and Agricultural Implement Plants.		
Distribution of Fires.		
Sprinklered	15	56.0
Unsprinklered	12	44.0
Total	27	
Effect of Sprinklers.		
Practically extinguished fire	8	53.0
Held fire in check	6	40.0
No sprinklers operated	1	6.5
Total	15	
Processes Principally Responsible for Fires.		
Dipping	16	69.0
Furniture Factories.		
Distribution of Fires.		
Sprinklered	21	81.0
Unsprinklered	5	19.0
Total	26	
Effect of Sprinklers.		
Practically extinguished fire	13	62.0
Held fire in check	5	24.0
Unsatisfactory	2	9.5
No sprinklers operated	1	5.0
Total	21	

Processes Principally Responsible for Fires.		
Dipping	16	61.5
Oilcloth and Window Shade Factories.		
Distribution of Fires.		
Sprinklered	21	87.5
Unsprinklered	3	12.5
Total	24	
Effect of Sprinklers.		
Practically extinguished fire	9	43.0
Held fire in cheek	9	43.0
Unsatisfactory	2	9.5
No sprinklers operated	1	5.0
Total	21	
Process Principally Responsible for Fires.		
Coating	11	46.0
Varnishing	5	21.0
Painting	2	8.0
Printing and Lithographing.		
Distribution of Fires.		
Sprinklered	19	90.5
Unsprinklered	2	9.5
Total	21	
Effect of Sprinklers.		
Practically extinguished fire	13	68.5
Held fire in check	4	21.0
No sprinklers operated	2	10.5
Total	19	
Processes Principally Responsible for Fires.		
Benzine cleaning	10	48.0
Electrical Appliances.		
Distribution of Fires.		
Sprinklered	17	89.5
Unsprinklered	2	10.5
Total	19	
Effect of Sprinklers.		
Practically extinguished fire	7	41.0
Held fire in check	9	53.0
No sprinklers operated	1	6.0
Total	17	

Processes Principally Responsible for Fires.		
Dipping, Impregnating and Japanning	10	53.0
Paint and Varnish Works.		
Distribution of Fires.		
Sprinklered	9	50.0
Unsprinklered	9	50.0
Total	18	
Effect of Sprinklers.		
Practically extinguished fire.....	7	78.0
Held fire in check	1	11.0
Unsatisfactory	1	11.0
Total	9	
Processes Principally Responsible for Fires.		
Varnish thinning	5	28.0
Preparing and handling varnish	5	28.0
Machine Shops.		
Distribution of Fires.		
Sprinklered	10	62.5
Unsprinklered	6	37.5
Total	16	
Effect of Sprinklers.		
Practically extinguished fire.....	4	40.0
Held fire in check	5	50.0
No sprinklers operated.....	1	10.0
Total	10	
Process Principally Responsible for Fires.		
Benzine cleaning	3	19.0
Japanning	2	12.5
Patent Leather Works.		
Distribution of Fires.		
Sprinklered	4	36.0
Unsprinklered	7	64.0
Total	11	
Effect of Sprinklers.		
Practically extinguished fire	2	50.0
Held fire in check.....	2	50.0
Total	4	
Processes Principally Responsible for Fires.		
Mixing or handling daub or varnish	7	64.0

SPRINKLER FIRE RECORD.

EFFECT OF SPRINKLERS.

As Regards Extinguishment.

	Benzine. No. of Fires.	Benzine. Per Cent of Benzine.	Alcohol. No. of Fires.	Alcohol. Per Cent of Alcohol.	Kerosene. No. of Fires.	Kerosene. Per Cent of Kerosene.
Extinguished Fire.....	234	64.3	31	79.5	12	70.6
Held Fire in Check.....	120	33.0	8	20.5	4	23.5
Unsatisfactory	10	2.7	..	....	1	5.9
Totals	364		39		17	

	Fuel Oil. No. of Fires.	Fuel Oil. Per Cent of Fuel Oil.	Miscellaneous. No. of Fires.	Miscellaneous. Per Cent of Misc.	Total Fires. No. of Fires.	Total Fires. Per Cent of Total.
Extinguished Fire.....	13	50.0	19	67.8	309	65.2
Held Fire in Check.....	13	50.0	8	28.6	153	32.3
Unsatisfactory	..	....	1	3.6	12	2.5
Totals.....	26		28		474	

As Regards Losses.

	Benzine. No. of Fires.	Benzine. Per Cent of Benzine.	Alcohol. No. of Fires.	Alcohol. Per Cent of Alcohol.	Kerosene. No. of Fires.	Kerosene. Per Cent of Kerosene.
No Claim.....	135	37.1	15	38	6	35.3
Small Loss, or $1,000 and Less.....	177	48.6	16	41	5	29.4
Large Loss, or over $1,000	52	14.3	8	21	6	35.3
Totals	364		39		17	

	Fuel Oil. No. of Fires.	Fuel Oil. Per Cent of Fuel Oil.	Miscellaneous. No. of Fires.	Miscellaneous. Per Cent of Misc.	Total Fires. No. of Fires.	Total Fires. Per Cent of Total.
No Claim.....	13	50.0	6	21.4	175	37.0
Small Loss.....	11	42.3	15	53.6	224	47.3
Large Loss.....	2	7.7	7	25.0	75	15.7
Totals	26		28		474	

NUMBER OF SPRINKLERS OPENED.

BENZINE.

No. of Sprinklers Operating.	Extinguished Fire. No. of Fires.	Extinguished Fire. Per Cent.	Held Fire in Check. No. of Fires.	Held Fire in Check. Per Cent.	Unsatisfactory. No. of Fires.	Total. No. of Fires.	Total. Per Cent.	No. of Sprinklers Operating.	No. of Fires.	Per Cent of Whole.
1	88	37.6	18	14.9	1	107	29.4	1	107	29.3
2	35	15.0	21	17.3	..	56	15.3	2 or less	163	44.7
3	21	9.0	10	8.3	1	32	8.8	3 or less	195	53.5

No. of Sprinklers Operating.	Extinguished Fire. No. of Fires.	Per Cent.	Held Fire in Check. No. of Fires.	Per Cent	Unsatisfactory. No. of Fires.	Total. No. of Fires.	Per Cent.	No. of Sprinklers Operating.	No. of Fires.	Per Cent of Whole.
4	14	6.0	5	4.1	..	19	5.2	4 or less	214	58.7
5	11	4.7	8	6.7	..	19	5.2	5 or less	233	63.9
6 to 9 inc.	31	13.5	12	9.9	..	43	11.8	Less than 10	276	75.7
10 to 24 inc.	23	9.8	25	20.6	1	49	13.4	Less than 25	325	89.1
25 to 49 inc.	7	3.0	10	8.3	1	18	4.9	Less than 50	343	94.0
50 and over	4	1.7	12	9.9	6	22	6.0	50 and over	22	6.0
Total....	234		121		10	365				

Average number of sprinklers opened, not including unsatisfactory, 10.85.

ALCOHOL.

No. of Sprinklers Operating.	Extinguished Fire. No. of Fires.	Per Cent.	Held Fire in Check. No. of Fires.	Per Cent.	Unsatisfactory. No. of Fires.	Total. No. of Fires.	Per Cent.	No. of Sprinklers Operating.	No. of Fires.	Per Cent of Whole.
1	8	25.8	..	.....		8	21.1	1	8	21.0
2	7	22.6	1	14.3.....		8	21.1	2 or less	16	42.2
3	5	16.1	1	14.3.....		6	15.8	3 or less	22	58.0
4	4	13.0	..	.....		4	10.5	4 or less	26	68.5
5	1	3.2	..	.....		1	2.6	5 or less	27	71.0
6 to 9 inc.	1	3.2	2	28.6.....		3	7.9	Less than 10	30	79.0
10 to 24 inc.	5	16.1	2	28.6.....		7	18.4	Less than 25	37	97.5
25 to 49 inc.	..	..	1	14.3.....		1	2.6	Less than 50	38	100.0
50 and over	..	..	..	.....		..	..	50 and over	..	...
Total....	31		7			38				

Average number of sprinklers opened, 8.0.

TOTAL.

No. of Sprinklers Operating.	Extinguished Fire. No. of Fires.	Per Cent.	Held Fire in Check. No. of Fires.	Per Cent.	Unsatisfactory. No. of Fires.	Total. No. of Fires.	Per Cent.	No. of Sprinklers Operating.	No. of Fires.	Per Cent of Whole.
1	107	34.7	20	13.0	1	128	27.0	1	128	27.0
2	46	14.9	24	15.7	..	70	14.8	2 or less	198	41.8
3	30	9.7	15	9.8	1	46	9.7	3 or less	244	51.5
4	24	7.8	5	3.3	..	29	6.1	4 or less	273	57.6
5	14	4.5	9	5.9	..	23	4.9	5 or less	296	62.5
6 to 9 inc.	38	12.3	18	11.7	..	56	11.8	Less than 10	352	74.3
10 to 24 inc.	36	11.6	33	21.6	1	70	14.8	Less than 25	422	89.1
25 to 49 inc.	8	2.6	13	8.5	1	22	4.6	Less than 50	444	93.7
50 and over	6	1.9	16	10.5	8	30	6.3	50 and over	30	6.3
Total....309			153		12	474				

Average number of sprinklers opened, not including unsatisfactory, 10.55.

BRIEF SUMMARY OF SPRINKLER FAILURES.

Benzine.

745. Shade Cloth Factory. A three-story hollow frame building with single floors and wood sheathed ceilings, occupied for the sizing, painting and drying of shade cloth. Building sprinklered with Mackey pendant heads, dry system. Fire started in the coating machine from frictional electricity which ignited the naphtha vapor.

It was the testimony of those present at the time fire started that the sprinklers opened promptly and that the dry valve tripped without delay. The old Mackey head was not quite as sensitive as the present approved sprinklers. Probably the slight delay, due to lack of sensitiveness of the heads, together with the time consumed in the tripping of the dry valve and the filling of the system with water, gave the fire a good start. It is doubtful if even a standard equipment would have caught this fire, as heads were opened on all floors at once and a draught made upon the system and its supplies not provided for even in standard sprinkler installations.

1668. Screen Door Factory. This plant consisted of a factory and two warehouses each about 200 by 60 feet, frame, two stories and attic, standing in a row parallel to each other lengthwise with about fifty feet of space between the buildings. The power house, dry kilns, and a smaller brick warehouse also stood near the main group of three buildings.

The fire occurred in paint department, second floor of factory. There was a quantity of benzine-thinned paint and priming mixture in dip tanks. The sprinkler system was in service with water supply from gravity tank and automatic fire pump. The water supply was soon diverted from the sprinklers to hose streams. The hose streams were in part taken from the fire pump of the plant and part from the city main hydrants. The fire was not controlled in the first building by either the sprinklers or the hose, and the fall of the building, and breaking of large pipes weakened the water supply so that little could be done to save the other buildings, with the result that the entire plant was destroyed. Specific cause of failure could not be determined.

2092. Linoleum Factory. Fire started from friction of burlap drawn from coating mill into drying rack in the fourth story of coating and drying building. This was one of the drying rooms in which a perforated pipe system had been installed in addition to the sprinklers, but both systems were evidently of little service except to saturate the floor, and the fourth story was burned out.

The sprinklers were spaced very closely with branch lines in all of the tracks and alleyways, and the piping conformed to schedule.

The water pressure from city main was about forty-five pounds at the ground level and a pressure of 100 pounds from the fire pump was put on the sprinkler mains immediately after the fire was discovered, and

it is reported that the supply was ample for sprinklers and perforated pipes.

Several lines of mill yard hose were brought into service and the fire was extinguished by aid of the public department, two alarms being sounded.

The highly inflammable nature of the stock and the light wooden racks in the drying rooms seemed to make it impossible to promptly check a fire in that department, and it was suggested that the process of coating, as done in this building, should be isolated in a one-story building and that the drying racks should be built of iron.

3992. Rubber Works. This was a wooden frame building with brick filled walls. Floor of light open joist construction. There was an old Walworth system of sprinklers supplied by a 3,000-gallon gravity tank that only gave seven pounds pressure on the sprinklers that operated. Fire occurred on fourth floor where seamless rubber goods were made. Large quantities of rubber cement and naphtha were used, the cement being mixed in room. At time of fire there was a large cement mixer and several tumbling barrels holding some 300 gallons of naphtha; also about twelve barrels of cement in metal tanks; two dip tanks which held 100 gallons each; five holding fifty to sixty gallons each; one holding thirty gallons, and about fifteen gallons of carbon bi-sulphide in another dip tank. It was natural that a fire once started would be a very hot one and spread rapidly. Pumps were started, but they supplied four hose streams, and as a large number of sprinklers operated, the water was not sufficient to control the fire.

5883. Furniture Factory. Fire occurred on top floor of building of ordinary brick construction occupied for storage and varnish dipping. Fire occurred at dip tank and communicated with roof joists. Building was equipped with Grinnell metal disc sprinklers, old style equipment, wet system, the only supply being a 2,600-gallon gravity tank. Tank was soon exhausted and sprinklers of little service. There was a steamer connection, but fire department did not use it. Some of the sprinklers fused, but failed to open, probably due to sticking at the seat.

6544. Varnish Works. Plant consisted of a number of buildings from one to three stories in height, of fair ordinary joist contruction.

Fire started on third floor No. 1 where varnish was stored in tanks and at a tank that was in process of filling. It appeared to have been a flash fire from some cause not ascertainable, which soon enveloped the surrounding tanks which were covered.

The fire protection of plant consisted of a single supply equipment of International 1903 sprinklers installed under the rules of 1896, and spaced eight feet by ten feet across joist. The supply was a 25,000-gallon gravity tank on steel trestle in yard, giving about twenty-five pounds pressure where fire started. There was also a fire engine connection which was not used.

The sprinkler system seems to have operated promptly, and from statements made by firemen it would appear that while tank supply lasted,

spread of fire was much retarded; and it is likely that with a standard automatic supply of heavy pressure in addition to tank supply, fire would have been controlled or at least confined to building of origin, as the sprinklers of this building were under outside control.

8423. Incandescent Electric Lamp Factory. Fire occurred in room where carbon filaments were flashed in a gasolene vapor. Cause of the fire was uncertain. It was claimed that the girl who operated the apparatus was reattaching a one and one-half gallon can which she had filled with gasolene, when it was ignited by a spark from the trigger switch. In some way the can was tipped over, the contents running along the bench to the next machine, when a spark ignited it. There was no explosion, but the flame flashed up and back to the can. The foreman seized the blazing can and carried it out, his arm being badly burned in so doing. One sprinkler head opened, but the water instead of quenching the fire, spread it the more. It was extinguished by hand chemicals. The fire department was called, but the fire was out when it arrived.

8850. Rubber Works. Fire occurred in a detached cement mixing building, brick walls, joist floors, covered with heavy sheet iron. Roof joist, boards and slag covered. The side walls were blank, end walls had windows, and there was also large lantern skylight.

Plant was in operation and fire was discovered by employee. It occurred in a rubber cement mixer from unknown cause.

The building was equipped with International sprinklers, 1905 standard pipe sizes. Sprinklers spaced six feet by five feet; no obstruction to distribution; wet system supplied by waterworks. Sprinklers were of no value, as a severe explosion occurred, wrecking the system.

12821. Rubber Works. Fire occurred in spreading room. Static electricity developed by rapidly moving cloth in process ignited naphtha vapor from rubber cement used in process. Sprinklers said to have spread the fire and it was only extinguished by means of steam.

12964. Metal Worker. A pail of gasolene was ignited by a spark from an emery wheel. Employee attempted to carry pail from building. No details concerning sprinkler failure were given.

Kerosene.

7905. Woolen Mill. Fire started in a card room on the third floor of the mill, caused by an exploding lamp. The main mill was protected by Grinnell automatic sprinklers supplied by a tank of 1,650 gallons placed ten or twelve feet above the sprinklers of the card room where the fire started. There were also two small fire pumps connected to the sprinklers. The sprinklers failed to check the fire and it burned through the floor to the spinning room above and got beyond control of the mill apparatus.

Miscellaneous Indeterminate.

10253. Metal Worker. Fire occurred in lacquer room, and failure was due to fact that sprinklers were shut off for repairs.

METHODS OF EXTINGUISHMENT WHERE NO SPRINKLERS OPERATED.

(Excluding Large Losses.)

Benzine Fires.

	Per Cent.
Smothered by wet blankets, bagging, etc.	21.5
Smothered by tank covers	4.0
Hand chemicals	13.5
Hand chemicals and pails (sand and water)	11.0
Pails (sand and water)	16.0
Pails, wet blankets, bagging, etc.	12.0
Chemicals and wet blankets, bagging, etc.	4.0
Fire department	4.0
Dry powder	3.0
Chemical and soapstone	1.5
Beaten out	1.5
Miscellaneous	8.0

Alcohol Fires.

	Per Cent.
Pails	30
Pails and wet blankets, etc	20
Chemicals	30
Pails and chemicals	10
Smothered by tank covers	10

A RECORD OF CASUALTIES.

Total number of fires where casualties occurred	38
Benzine	23
Alcohol	8
Kerosene	3
Miscellaneous	4
Total number of casualties	90
Casualties in unsprinklered properties	47
Casualties under sprinkler protection	43
Injuries	53
In unsprinklered properties	20
Under sprinkler protection	33
Fatalities	37
In unsprinklered properties	27
Under sprinkler protection	10

Classification of Casualties.

- Benzine 56
  - Injuries 29
  - Fatalities 27
    - Unsprinklered 38
      - Injuries 14
      - Fatalities 24
    - Sprinklered 18
      - Injuries 15
      - Fatalities 3
- Alcohol 12
  - Injuries 7
  - Fatalities 5
    - Unsprinklered 2
      - Injuries 0
      - Fatalities 2
    - Sprinklered 10
      - Injuries 7
      - Fatalities 3
- Kerosene 16
  - Injuries 13
  - Fatalities 3
    - Unsprinklered 3
      - Injuries 3
      - Fatalities 0
    - Sprinklered 13
      - Injuries 10
      - Fatalities 3
- Miscellaneous 6
  - Injuries 4
  - Fatalities 2
    - Unsprinklered 4
      - Injuries 3
      - Fatalities 1
    - Sprinklered 2
      - Injuries 1
      - Fatalities 1

EFFICIENCY OF WATER SUPPLIES TO SPRINKLER SYSTEMS.					Per Cent. of Fires.			Average Pressure.			Average Number Sprinklers Opened	
Primary Water Supply.	Number of fires	Per cent of fires	Average pressure	Average number sprinklers opened	Extinguished fire (or practically extinguished)	Held fire in check	Unsatisfactory	Extinguished fire (or practically extinguished)	Held fire in check	Unsatisfactory	Extinguished fire (or practically extinguished)	Held fire in check
Waterworks,	207	59.6	63	9.2	39.3	19.3	1.15	65.0	57.5	58	6.2	15.9
Gravity tank,	53	15.3	30	16.5	5.8	8.4	1.15	36.5	28.0	13	9.6	23.7
Pressure tank,	60	17.3	89	10.9	15.3	2.0	..	89.0	85.0	..	7.9	33.7
Automatic pump,	27	7.8	69	12.0	4.9	2.6	0.3	67.0	75.0	55	7.9	22.5
Total,	347		63	10.9	65.1	32 3	2.6	68.5	53.0	38	7.0	19 5

EFFICIENCY OF WATER PRESSURES ON SPRINKLER SYSTEMS.					Per Cent. of Fires.			Average Pressure.			Average Number Sprinklers Opened	
Pressure on Sprinklers.	Number of fires	Per cent. of fires	Average pressure	Average number sprinklers opened	Extinguished fire (or practically extinguished)	Held fire in check	Unsatisfactory	Extinguished fire (or practically extinguished)	Held fire in check	Unsatisfactory	Extinguished fire (or practically extinguished)	Held fire in check
Less than 15 lbs.,	10	2.9	10.0	3.2	0.9	1.2	0.9	12.0	8.5	9	1.3	7.0
15 to 24 inclusive,	17	4.9	19.0	37.3	2.3	2.6	..	20.0	19.0	..	25.9	47.4
25 to 49 inclusive,	90	26.0	37.0	11.9	13.5	11.5	0.9	38.0	35.0	38	5.7	20.0
50 and over,	230	66.2	78.5	8.9	48.5	17.0	0.9	80.0	73.5	67	6.6	15.8
Total,	347		63.0	10.9	65.1	32.3	2.6	68.5	53.0	38	7.0	19.5

EFFICIENCY OF WET OR DRY SPRINKLER SYSTEMS.					Per Cent. of Fires.			Average Pressure.			Average Number Sprinklers Opened	
Wet or Dry System.	Number of fires	Per cent. of fires	Average pressure	Average number sprinklers opened	Extinguished fire (or practically extinguished)	Held fire in check	Unsatisfactory	Extinguished fire (or practically extinguished)	Held fire in check	Unsatisfactory	Extinguished fire (or practically extinguished)	Held fire in check
Wet system,	283	81.5	62.5	9.2	53.0	26.8	1.7	68.0	53	30	5.5	17.3
Dry system,	64	18.5	63.5	18.2	12.1	5.5	0.9	69.0	53	53	13.8	30.8
Total,	347		63.0	10.9	65.1	32.3	2.6	68.5	53	38	7.0	19.5

BENZINE.

EFFICIENCY OF WATER SUPPLIES TO SPRINKLER SYSTEMS —As Regards Amount of Loss.					Per Cent. of Fires.			Average Pressure.			Average Number Sprinklers Opened.		
Primary Water Supply.	Number of fires	Per cent. of fires	Average pressure	Average number sprinklers opened	No claim	Small loss	Large loss	No claim	Small loss	Large loss	No claim	Small loss	Large loss
Waterworks,	207	59.6	63	9.2	19.6	32.9	7.2	63	64	56.5	3.7	6.6	39.9
Gravity tank,	53	15.3	30	16.5	3.8	7.8	3.8	32	33	23.0	4.8	9.3	57.3
Pressure tank,	60	17.3	89	10.9	8.7	7.2	1.4	92	90	62.0	2.1	7.0	80.3
Automatic pump,	27	7.8	69	12.0	4.0	2.0	1.7	73	63	68.0	6.6	10.0	35.0
Total,	347		63	10.9	36.1	49.9	14.1	68	63	49.5	3.8	7.2	48.4

EFFICIENCY OF WATER PRESSURES ON SPRINKLER SYSTEMS —As Regards Amount of Loss.					Per Cent. of Fires.			Average Pressure.			Average Number Sprinklers Opened.		
Pressure on Sprinklers.	Number of fires	Per cent. of fires	Average pressure	Average number sprinklers opened	No claim	Small loss	Large loss	No claim	Small loss	Large loss	No claim	Small loss	Large loss
Less than 15 lbs.,	10	2.9	10.0	3.2	0.9	1.1	0.9	9	10.0	10.0	1.3	5.3	12.0
15 to 24 inclusive,	17	4.9	19.0	37.3	0.9	2.3	1.7	19	19.5	19.0	1.3	12.3	88.7
25 to 49 inclusive,	90	26.0	37.0	11.9	8.1	13.0	4.9	36	38.0	34.0	3.9	7.1	43.2
50 and over,	230	66.2	78.5	8.9	26.2	33.5	6.6	81	77.0	74.0	3.9	7.0	42.5
Total,	347		63.0	10.9	36.1	49.9	14.1	68	63.0	49.5	3.8	7.2	48.4

EFFICIENCY OF WET OR DRY SPRINKLER SYSTEMS. —As Regards Amount of Loss.					Per Cent. of Fires.			Average Pressure.			Average Number Sprinklers Opened.		
Wet or Dry System.	Number of fires	Per cent. of fires	Average pressure	Average number sprinklers opened	No claim	Small loss	Large loss	No claim	Small loss	Large loss	No claim	Small loss	Large loss
Wet system,	283	81.5	62.5	9.2	29.5	41.5	10.7	68.5	62.5	46.0	3.8	6.1	40.1
Dry system,	64	18.5	63.5	18.2	6.6	8.4	3.4	64.0	65.0	59.5	3.5	12.5	80.2
Total,	347		63.0	10.9	36.1	49.9	14.1	68.0	63.0	49.5	3.8	7.2	48.4

ALCOHOL.

EFFICIENCY OF WATER SUPPLIES TO SPRINKLER SYSTEMS.					Per Cent. of Fires.			Average Pressure.			Average Number Sprinklers Opened	
Primary Water Supply.	Number of fires	Per cent. of fires	Average pressure	Average number sprinklers opened	Extinguished fire (or practically extinguished)	Held fire in check	Unsatisfactory	Extinguished fire (or practically extinguished)	Held fire in check	Unsatisfactory	Extinguished fire (or practically extinguished)	Held fire in check
Waterworks,	22	61	59	5.1	47.2	13.9	..	61	52	..	4.4	8.0
Gravity tank,	5	14	22	12.2	11.1	2.8	..	23	20	..	6.7	34.0
Pressure tank,	9	25	88	3.4	25.0	..	..	88	..	..	3.4	..
Automatic pump,	..	..	..	..	..	..	..	..	..	..	..	..
Total,	36		61	5.8	83.3	16.7	..	64	47	..	4.4	12.3

EFFICIENCY OF WATER PRESSURES ON SPRINKLER SYSTEMS.					Per Cent. of Fires.			Average Pressure.			Average Number Sprinklers Opened	
Pressure on Sprinklers.	Number of fires	Per cent. of fires	Average pressure	Average number sprinklers opened	Extinguished fire (or practically extinguished)	Held fire in check	Unsatisfactory	Extinguished fire (or practically extinguished)	Held fire in check	Unsatisfactory	Extinguished fire (or practically extinguished)	Held fire in check
Less than 15 lbs.,	1	2.8	10	2.0	2.8	..	..	10.0	..	..	2.0	..
15 to 24 inclusive,	2	5.5	21	22.5	2.8	2.8	..	22.0	20.0	..	11.0	34.0
25 to 49 inclusive,	8	22.2	37	5.4	16.7	5.6	..	35.5	42.5	..	5.3	5.5
50 and over,	25	69.5	74	4.6	61.0	8.3	..	76.0	59.0	..	4.0	9.7
Total,	36		61	5.8	83.3	16.7	..	64.0	47.0	..	4.4	12.3

EFFICIENCY OF WET OR DRY SPRINKLER SYSTEMS.					Per Cent. of Fires.			Average Pressure.			Average Number Sprinklers Opened	
Wet or Dry System.	Number of fires	Per cent. of fires	Average pressure	Average number sprinklers opened	Extinguished fire (or practically extinguished)	Held fire in check	Unsatisfactory	Extinguished fire (or practically extinguished)	Held fire in check	Unsatisfactory	Extinguished fire (or practically extinguished)	Held fire in check
Wet system,	28	78	61	4.5	66.6	11.1	..	64	43	..	3.0	13.0
Dry system,	8	22	62	10.0	16.7	5.6	..	64	55	..	9.9	11.0
Total,	36		61	5.8	83.3	16.7	..	64	47	..	4.4	12.3

ALCOHOL.

EFFICIENCY OF WATER SUPPLIES TO SPRINKLER SYSTEMS —As Regards Amount of Loss.					Per Cent. of Fires.			Average Pressure.			Average Number Sprinklers Opened.		
Primary Water Supply.	Number of fires	Per cent. of fires	Average pressure	Average number sprinklers opened	No claim	Small loss	Large loss	No claim	Small loss	Large loss	No claim	Small loss	Large loss
Waterworks,	22	61	59	5.1	11.1	33.3	16.6	55.0	65	49.5	1.7	3.2	11.5
Gravity tank,	5	14	22	12.2	11.1	..	2.8	23.0	..	20.0	6.7	..	34.0
Pressure tank,	9	25	88	3.4	16.7	5.6	2.8	87.5	90	85.0	1.5	3.0	16.0
Automatic pump,	..	..	..	..	..	..	..	..	..	..	..	..	..
Total,	36		61	5.8	38.9	38.9	22.2	60.0	69	50.0	3.1	3.2	14.9

EFFICIENCY OF WATER PRESSURES ON SPRINKLER SYSTEMS —As Regards Amount of Loss.					Per Cent. of Fires.			Average Pressure.			Average Number Sprinklers Opened.		
Pressure on Sprinklers.	Number of fires	Per cent. of fires	Average pressure	Average number sprinklers opened	No claim	Small loss	Large loss	No claim	Small loss	Large loss	No claim	Small loss	Large loss
Less than 15 lbs.,	1	2.8	10	2.0	2.8	..	..	10	..	..	2.0	..	..
15 to 24 inclusive,	2	5.5	21	22.5	2.8	..	2.8	22	..	20	4.0	..	34.0
25 to 49 inclusive,	8	22.2	37	5.4	8.3	5.6	8 3	35	37.5	29	5.3	3.0	7.0
50 and over,	25	69.5	74	4.6	25.0	33.3	11.1	78	74.0	66	1.6	3.3	16.0
Total,	36		61	5.8	38.9	38.9	22.2	60	69.0	50	3.1	3.2	14.9

EFFICIENCY OF WET OR DRY SPRINKLER SYSTEMS. —As Regards Amount of Loss.					Per Cent. of Fires.			Average Pressure.			Average Number Sprinklers Opened.		
Wet or Dry System.	Number of fires	Per cent. of fires	Average pressure	Average number sprinklers opened	No claim	Small loss	Large loss	No claim	Small loss	Large loss	No claim	Small loss	Large loss
Wet system,	28	78	61	4.5	33.3	30.6	13.9	62.0	70	38	3.2	2.5	12.2
Dry system,	8	22	62	10.0	5.6	8.3	8.3	47.5	63	70	2.5	6.0	19.3
Total,	36		61	5.8	38.9	38.9	22.2	60.0	69	50	3.1	3.2	14.9

EFFICIENCY OF WATER SUPPLIES TO SPRINKLER SYSTEMS.					Per Cent. of Fires.			Average Pressure.			Average Number Sprinklers Opened	
Primary Water Supply.	Number of fires	Per cent. of fires	Average pressure	Average number sprinklers opened	Extinguished fire (or practically extinguished)	Held fire in check	Unsatisfactory	Extinguished fire (or practically extinguished)	Held fire in check	Unsatisfactory	Extinguished fire (or practically extinguished)	Held fire in check
Waterworks,	262	58.6	63.0	9.0	38.5	19.0	1.1	65	59.0	60	5.9	15.7
Gravity tank,	72	16.1	29.0	16.5	6.9	8.1	1.1	33	32.0	13	9.0	25.4
Pressure tank,	78	17.5	89.0	10.2	15.5	2.0	..	89	87.0	..	7.8	28.4
Automatic pump,	35	7.8	72.0	11.5	5.4	2.2	0.2	71	74.5	55	7.0	23.8
Total,	447		62.5	10.6	66.3	31.3	2.4	68	54.0	37	6.8	19.5

EFFICIENCY OF WATER PRESSURES ON SPRINKLER SYSTEMS.					Per Cent. of Fires.			Average Pressure.			Average Number Sprinklers Opened	
Pressure on Sprinklers.	Number of fires	Per cent. of fires	Average pressure	Average number sprinklers opened	Extinguished fire (or practically extinguished)	Held fire in check	Unsatisfactory	Extinguished fire (or practically extinguished)	Held fire in check	Unsatisfactory	Extinguished fire (or practically extinguished)	Held fire in check
Less than 15 lbs.,	13	2.9	10.0	4.5	0.9	1.1	0.9	12.0	9.5	9.5	1.5	10.6
15 to 24 inclusive,	24	5.4	19.5	32.6	2.7	2.7	..	20.0	19.0	..	18.9	46.4
25 to 49 inclusive,	110	24.5	36.5	12.1	13.2	10.7	0.6	37.5	35.0	38.0	6.1	20.4
50 and over,	300	67.2	78.0	8.5	49.5	16.8	0.9	80.0	73.5	65.0	6.4	15.4
Total,	447		62.5	10.6	66.3	31.3	2.4	68.0	54.0	37.0	6.8	19.5

EFFICIENCY OF WET OR DRY SPRINKLER SYSTEMS.					Per Cent. of Fires.			Average Pressure.			Average Number Sprinklers Opened	
Wet or Dry System.	Number of fires	Per cent. of fires	Average pressure	Average number sprinklers opened	Extinguished fire (or practically extinguished)	Held fire in check	Unsatisfactory	Extinguished fire (or practically extinguished)	Held fire in check	Unsatisfactory	Extinguished fire (or practically extinguished)	Held fire in check
Wet system,	349	78.1	62.0	9.1	51.8	24.8	1.5	67	53	27	5.5	17.4
Dry system,	98	21.9	65.5	15.8	14.5	6.5	0.9	71	56	55	11.3	27.9
Total,	447		62.5	10.6	66.3	31.3	2.4	68	54	37	6.8	19.5

TOTAL.

EFFICIENCY OF WATER SUPPLIES TO SPRINKLER SYSTEMS —As Regards Amount of Loss.					Per Cent. of Fires.			Average Pressure.			Average Number Sprinklers Opened.		
Primary Water Supply.	Number of fires	Per cent. of fires	Average pressure	Average number sprinklers opened	No claim	Small loss	Large loss	No claim	Small loss	Large loss	No claim	Small loss	Large loss
Waterworks,	262	58.6	63.0	9.0	18.8	32.0	7.8	64	65.0	61.0	3.6	6.2	36.4
Gravity tank,	72	16.1	29.0	16.5	4.4	7.2	4.5	30	34.0	26.5	5.3	9.8	48.8
Pressure tank,	78	17.5	89.0	10.2	8.9	7.0	1.6	90	91.0	72.0	2.3	6.5	71.8
Automatic pump,	35	7.8	72.0	11.5	4.3	2.0	1.5	74	69.0	79.0	7.3	9.7	30.0
Total,	447		62.5	10.6	36.4	48.2	15.4	67	63.5	49.0	3.9	7.0	43.2

EFFICIENCY OF WATER PRESSURES ON SPRINKLER SYSTEMS —As Regards Amount of Loss.					Per Cent. of Fires.			Average Pressure.			Average Number Sprinklers Opened.		
Pressure on Sprinklers.	Number of fires	Per cent. of fires	Average pressure	Average number sprinklers opened	No claim	Small loss	Large loss	No claim	Small loss	Large loss	No claim	Small loss	Large loss
Less than 15 lbs.,	13	2.9	10.0	4.5	0.9	0.9	1.1	9.5	14.0	27.0	1.5	5.3	18.5
15 to 24 inclusive,	24	5.4	19.5	32.6	1.1	2.0	2.2	20.0	19.5	19.5	3.2	11.4	66.4
25 to 49 inclusive,	110	24.5	36.5	12.1	7.4	12.3	4 9	36.0	38.5	38.0	4.4	7.3	40.0
50 and over,	300	67.2	78.0	8.5	27.0	33.0	7.2	80.0	76.0	81.0	3.9	6.7	39.0
Total,	447		62.5	10.6	36.4	48.2	15.4	67.0	63.5	49.0	3.9	7.0	43.2

EFFICIENCY OF WET OR DRY SPRINKLER SYSTEMS. —As Regards Amount of Loss					Per Cent. of Fires.			Average Pressure.			Average Number Sprinklers Opened.		
Wet or Dry System.	Number of fires	Per cent. of fires	Average pressure	Average number sprinklers opened	No claim	Small loss	Large loss	No claim	Small loss	Large loss	No claim	Small loss	Large loss
Wet system,	349	78.1	62.0	9.1	27.7	39 4	11.0	67	62.5	45	3.7	5.9	37.9
Dry system,	98	21.9	65.5	15.8	8.7	8.8	4.4	67	68.0	58	4.5	11.5	57.6
Total,	447		62.5	10.6	36.4	48.2	15.4	67	63.5	49	3.9	7.0	43.2

TOTAL.

Fig. 1. Street in the City.

Showing tremendous velocity of the current even before the flood reached its height.

GENERAL FIRE RECORD.

Champion Coated Paper Co. Fire.

Special Report made up from Report of the Boston Manufacturers Mutual Fire Insurance Co. on the Hamilton Flood.

S-13901. During the storm that passed over the state of Ohio March 23d to March 26th, inclusive, the total amount of rainfall was more than twenty-five per cent of the yearly fall of that state, in some sections being as much as eleven inches. While many cities and towns were affected, the loss of life and property at Hamilton was greater than in any other. The usual channels of the rivers were entirely inadequate to carry the water, and the flood conditions prevailed over a wide area, and all means of communication and transportation were for a time broken. See Fig. 1.

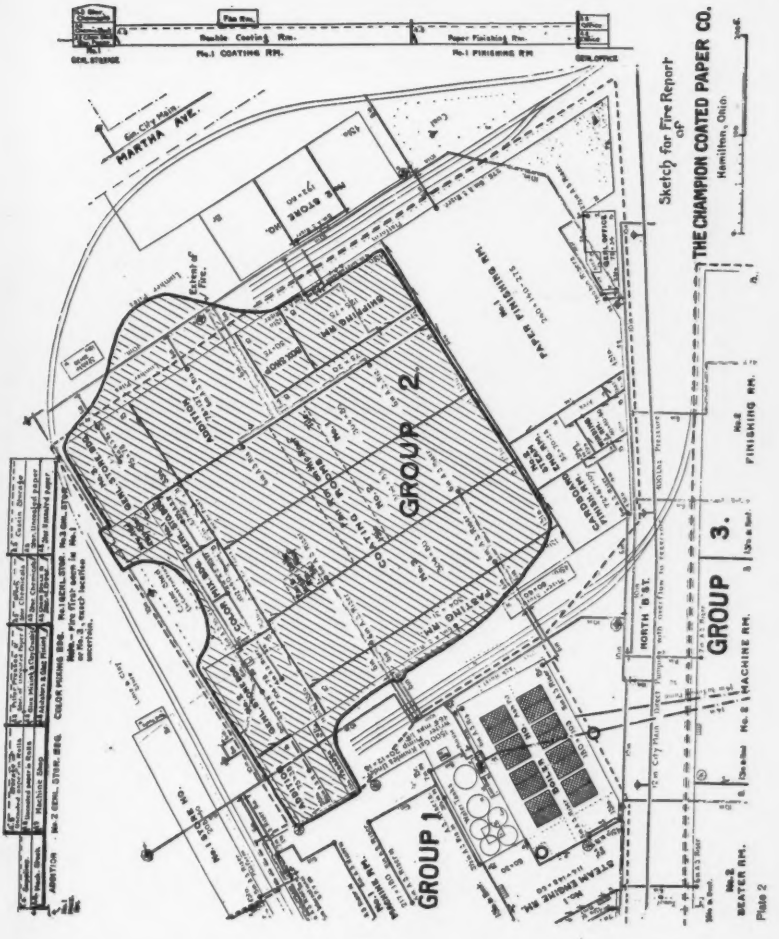


Fig. 2.

During the early stages of the flood the public water supply was disabled, due to the carrying away of the bridges, one of which carried a sixteen-inch water main of the city, while the twenty-inch water main laid under the bed of the river was broken by the scour. The pumping station was flooded and the city reservoir of no service, as it was necessary to shut it off on account of the broken pipes. In consequence of this the fire protection of the plant was absolutely out of service and there was practically no means at hand for extinguishment of the fire after it had once gained headway.

The Champion Coated Paper Company is located on the west bank of the Miami River, which divides the city of Hamilton. The business center and most of the other manufacturing plants are located on the east side of the river. All bridges, except a railroad bridge above the city, were washed away.

Dangerous conditions were first apparent at the mill on Tuesday, March 25th. There had been trouble early in the morning from water backing up through the sewers in the concrete basement of No. 2 beater building. There was a large quantity of lime in casks stored in this basement. Fire started in one of these casks by the slaking of the lime, and was extinguished by men with shovels by scooping up water from the floor. A start was then made to remove the lime to No. 2 storehouse, but this was stopped by the chemist, who wisely thought it was safer to leave it where it was on account of the combustible construction of the storehouse. A second fire started, and was fought with hose streams until the rising water compelled their abandonment. The flood completed the work of extinguishment without fire damage to the building.

The public waterworks and the electric lighting station were obliged to suspend service early in the day, and the large pipes across the river were broken, thus cutting off all water supply. The river had risen above its banks and the water had extinguished the fires under the boilers at the Champion Plant by 10 a. m. The coating plant, where the buildings were mostly one story, and the first stories of the other mills were flooded during the forenoon.

The water, continuing to rise, flowed through North B Street with a velocity said to be that of a mill race. Twenty-six men who had remained in No. 3 group were unable to cross the street and were finally rescued about 5 p. m. by an improvised cradle which was pulled by a rope over the electric cables from the roof of No. 2 beater building to roof of power house. It was feared that group 3 would wash away, a disaster that was averted by the strongly constructed retaining wall, as shown in Fig. 3, that had been erected along the river bank. The flood reached its maximum about one o'clock Wednesday morning. There was a depth of water in North B Street between the mills of seventeen feet with fifteen feet of water above the floor of finishing room of coating mill. The water then receded so that by Thursday night communication between the different groups could be re-established.

The mechanical engineer had ordered two or three men to remain for extra watch service and the usual night watchman of No. 1 group reported for duty. Several other men who could not get home also remained. Group 1 was accessible at all times from the high land to the west, and the three-story buildings of the coating plant could be reached over the roof of the addition between them and No. 1 machine room.

There was but one lantern in the party, however, and this was retained by the watchman of group 1, who made his usual rounds as far as possible. One of the men detailed for group 2 says that he walked through the upper floor of three-story buildings about 7 p. m., that every-

Fig. 3.

Showing the maximum height of water, and the great resistance afforded by the substantial construction of the retaining wall and the foundations of the mill.

thing appeared all right, but that having no lantern, and considering it dangerous to stay in the dark, he rejoined his companions in No. 1 group. Some of them looked about for a time and then, feeling powerless to do any good, laid down on the rags and slept more or less.

The Fire. Fire was first seen in the three-story buildings of the coating plant at the north end about midnight, or a little later, by people on the high land and by the watchman at No. 1, who awakened his companions. The effect of the whole catastrophe on men's minds was such that but vague recollections of time remain, so that it is difficult to fix the exact hour. When discovered, however, the fire had reached large proportions and there was no means at hand to combat it. A hose company of the Hamilton Fire Department, stationed on this side of the river, came; but, as there appeared to be nothing for them to do, they returned to their station. The wind was strong from the northwest.

The fire burned unchecked up to the north wall of No. 1 machine room, where the concrete roof prevented its further spread, the floor being under water. Parts of the eastern fire wall of the three-story building

fell, and this probably carried the fire from the three-story part, where the upper floors were heavily loaded with paper in rolls, into the one-story coating rooms, destroying everything until stopped by the fire wall at No. 1 finishing room. The posts and beams supporting the roof of the coating rooms burned and the roofs finally fell into the water, extinguishing the fire. The division walls between the coating rooms, weakened by fire and water, also collapsed.

Fig. 4.

Showing the pile of rubbish between No. 1 Storehouse, the Coating Mill and No. 1 Paper Mill, looking south. It was a fire in this rubbish that at one time hazarded No. 1 Mill.

Thursday morning fire gained headway in a huge pile of driftwood, rosin barrels, etc. shown in Fig. 4, that had washed in between No. 1 storehouse and No. 1 machine room. It was fought by a bucket brigade, using water, salt, and wet clay. Wet felts were also hung on the walls of the storehouse to protect the windows. In the face of these efforts, the fire gained headway and threatened the destruction of group 1, as the water was receding and the rubbish extended far into the basement of the machine room. The water falling below the boiler grates, fires were started under the boilers, using rosin for fuel. Although some uncertainty was felt as to the amount of water in the boilers and the feed pumps could not at once be started, steam pressure was gradually raised and the fire pump which was under water was started. This pump is located about five feet below the yard level, and the water at that time was above the throttle valve and hose connections on the pump. In spite of this, two hose streams were taken from it and the fire in the driftwood was extinguished. This excellent work saved group 1. The yard pipe system

was out of commission at this time, due to broken sprinkler feeders in burned buildings or those damaged by flood, and several indicator post valves were broken by falling walls.

The fire had continued in the lumber piles and wreckage to the north of the addition, threatening No. 2 storehouse. The smoldering ruins of the coating building threatened the finishing room through fire doors in the wall which were blocked open by floating rubbish, and thus gave an opportunity to the passage of fire as the water fell. Much of the mill hose equipment had been washed out of place and could not be found, so that there was not hose enough to reach from the fire pump to this part of the yard.

The management asked assistance of the provisionl government which had been established on the west side of the river, and help was asked from the town of Oxford. twelve miles distant. Communication with this town was still open by rail and by telephone, and the town fire department responded with a steam fire engine and hose company. This apparatus afforded the needed assistance to keep fire from spreading to the adjoining buildings at the north end of the yard. It is said that the steamer took its suction supply from pools in the street.

Cause of Fire. The main stock of chemicals used in the coating mill was located on the third floor of No. 1 general storage building, but working stocks were carried in the first and second stories of this building. It is understood that no lime was used in the coating process, although there may have been part of a barrel of lime on the premises remaining since some whitewashing had been done, and if so, this could have caused the fire.

There was a rumor that a burning shed was seen to drift against the coating mill and that fire broke out about half an hour later, but this is not confirmed, and the best evidence would appear to favor the theory that the fire started from the chemicals.

This plant was of excellent construction, and unusually well subdivided by fire walls. It had exceptionally good fire protection fed by an ample public water supply of one hundred pounds pressure and fire pump, and the plant was considered one of the very best of its class. All these ordinary means of fire protection were absolutely crippled, and there was nothing with which to fight the fire, which started practically at the time of maximum height of the flood, when the fire pump was at least twenty feet under water and fires under the boilers extinguished.

Lessons. In considering the lessons of this fire it should also be remembered that the frightful devastation by the flood, with the uncertainty of what was yet to happen, had turned the minds of the men from their usual channel, and in many cases the question uppermost with them was naturally that of self-preservation.

It is possible that the fire might have been extinguished in its incipiency had the men remained in the third-story building where the fire started, and this emphasizes the desirability of always standing by property until the last extremity.

Fig. 5.

The ruins of the Coating Mill as seen from top of Boiler House, looking northeast, showing the fire walls at the finishing room, which stopped the fire, also sections of the partially burned roofs as they fell into the water.

The hazard from chemicals, which heat quickly, or which are in themselves when mixed with other chemicals known to be dangerous, is also emphasized. These should be stored in incombustible rooms shut off from main buildings, or entirely separated from them, and only one day's supply should be brought into main buildings at any time, and should be so handled as to reduce the possibility of fire to a minimum.

The value of fire walls in any plant was also well illustrated. They saved the finishing room and they failed to save the coating rooms only because there were no sprinklers or hose streams available to reinforce them, and finally parts of this higher wall fell, carrying fire beyond, and there was nothing to check it.

The incombustible roof construction of No. 1 machine room also prevented the spread of the fire in that direction and avoided considerable loss in group 1, thus illustrating the fire-resisting qualities of concrete construction, there being nothing about the roof structure which the fire could feed.

The fire also emphasizes the desirability of locating indicator post gates, where possible, at a sufficient distance from buildings, so that they may not be liable to injury by falling walls. A number of those around the plant were injured, so that they could not be operated.

Alcohol Fire.

Special Report from Hudson Inspection Bureau (Member N. F. P. A.)

Construction. Ordinary frame, metal roof, part one and part three-story and basement, 20 x 125 feet.

Occupancy. First floor,—Brauer Bros., wholesale and retail liquor dealers; second and third floors, dwellings.

Lighting. Gasolene Lighting. F. P. gasolene lighting system with generator having two 2-gallon tanks, installed inside of building on first floor against south wall, about center of building.

Story of Fire. On May 8th at about 1.30 p. m., Mr. C. Brauer was in the rear part of the store bottling whiskey in the vicinity of where the gasolene lighting machine was located; Mr. A. Brauer was upstairs on the second floor dining with his family; in the front of the store was Ben Cohen, a boy 15 years of age, who was waiting for his employer, a liquor peddler who purchased his supplies from Brauer Bros.

A few minutes previous to 1.46 p. m. (the time the fire alarm was sent in), Mr. C. Brauer who was still in the rear of the store and who according to the story of Ben Cohen, had been smoking a cigarette, called to the boy to go upstairs and tell Mr. A. Brauer to come down to the store immediately. This the boy did and returned at once following Mr. A. Brauer to the rear of the store to where Mr. C. Brauer was standing

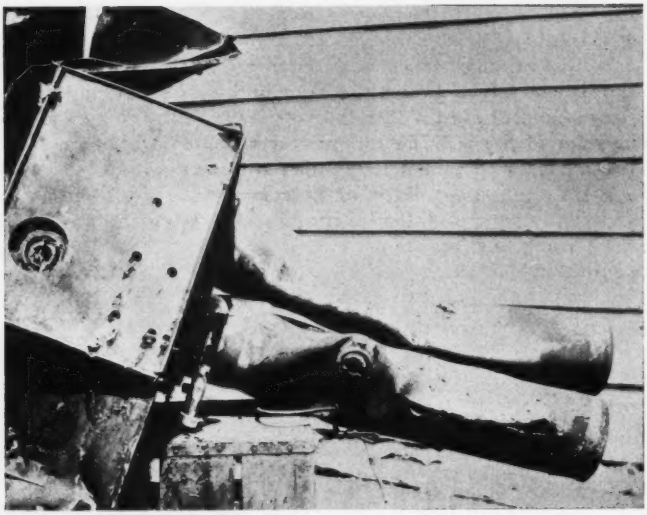


Photo from Chas. H. Fischer.

Tank of Gasolene Lighting System Exploded by Alcohol Fire.

while bottling whiskey. The boy states that on his arrival at this location the floor under an alcohol barrel was covered with a blue flame and that Mr. C. Brauer explained to his brother that he had put a bucket of water on the fire, and then turning to the boy directed him to go to the front of the store for a cork to place in an open bunghole in the top of the alcohol barrel which was over the fire. The boy returned immediately and handed the cork to Mr. C. Brauer, who placed the cork in the bunghole; it being too small it fell into the barrel. About the time he drew his hand from the barrel it exploded and scattered the alcohol all over the surroundings, Mr. C. Brauer and the boy. Mr. C. Brauer with his clothing and face covered with flame rushed to the extreme rear end of the store to a trough of water, but was unable to assist himself and before aid could reach him he died. The boy also full of flame rushed to the front of the store and was removed to the hospital, where he has been for six weeks, but is recovering.

Immediately after the barrel of alcohol exploded an alarm of fire was sent in from a street box about half block distant. The fire department responded at once, the closest company being located about 1½ blocks away. This company on approaching the fire heard an explosion which undoubtedly was from the gasolene tanks of the lighting machine. When this company entered the store they found the interior of the same in the vicinity of where the alcohol barrel and the gasolene

lighting machine were located one mass of flame. It is stated by the captain of the first company in that while fighting the fire a number of rumbling explosions took place. An examination after the fire showed that the heads of a number of whiskey barrels had blown out. A second alarm was sent in and the fire extinguished with considerable property loss.

After the fire, the gasolene lighting machine was dug out of the debris. A careful examination of this showed that the tanks were bulged considerably where the metal bands, which secure the machine to its base, are placed around the tanks. In addition one of the tanks has a bad rent about ten inches long bulging outward, which without any question of doubt was caused by an internal explosion. An examination of the escape pipe showed it to be free and the diaphragm of the "pressure relief" device was punctured.

Conclusions. This fire indicates the following: (1) in liquor stores and similar risks where whiskey and alcohol are kept there is the possibility of these inflammables leaking to the floor and becoming ignited; (2) whiskey and alcohol in barrels will explode and spread fire; (3) water is not always effective in extinguishing alcohol fires; (4) gasolene lighting machines when placed inside of buildings, in spite of the fact that the relief pipe is free and the "pressure relief" device is punctured, may explode when exposed to an external fire.

Points of Interest from Fire Reports.

These notes are intended to illustrate the efficiency or inefficiency of signaling, retardant or extinguishing agencies.

Alarm Service.

S-14241. Thermostats. Fire which occurred in shoe shop was discovered by an outsider, owing to the failure of the thermostats due to their poor spacing. The sprinklers operated first and prevented the thermostats from operating.

The standard spacing of thermostats calls for one at each sprinkler head.

S-14503. Manual Alarm. Fire which occurred in knitting mill was discovered by an employee, who at once operated the manual alarm. This was received at the central station a minute ahead of the waterflow signal, and the fire department were well on their way.

Wherever an automatic alarm system is installed, auxiliary manual boxes should also be located about the premises.

S-14503. Chemicals and Hand Hose. Fire which occurred in a knitting mill was quickly brought under control before the operation of the sprinklers by the prompt use of chemical extinguishers and hand hose from the sprinkler system. A moderate fire and water loss resulted.

The fire would undoubtedly have gained considerable headway before the sprinklers operated but for the effectual use of the auxiliary protective devices.

H-8641. Standpipes. Fire occurred on the tenth floor of a ten-story tenant manufacturing building. The fire department first attempted to use the standpipe, but owing to its small size, being two and a half inches with a two-inch nipple to valve, a sufficient supply of water could not be obtained. A second attempt was made to use the standpipe with 175 pounds pressure at the street, but a sufficient supply of water could not be obtained for an effective stream. Fire was finally fought with success by hose streams brought up the fire escape.

In this fire the small sized standpipe again demonstrated its limitations. We advocate only six-inch standpipes in buildings of this height.

S-14464. Steamer Connections. Fire occurred in a wholesale drug house, and both the primary and secondary supplies, consisting of pressure and gravity tanks, were quickly exhausted by the operation of the sprinklers. The nature of the fire was such that it could not be approached with hose streams. It was therefore suggested that two leads of hose with open butts be taken to roof and turned into gravity tank. In this manner three steamers supplied water to sprinkler equipment for over two hours, and fire was extinguished by the sprinklers.

Steamer connections to the sprinkler equipment would have been far more effective and should always be installed where steamers are an important part of the public protection.

H-8665. Steam Jet. Fire occurred in a brick dry kiln at a saw mill and box shop. Kiln was provided with steam jet which was put in operation, but the steam escaped through a ventilator in roof and did not prove effective.

Automatic Sprinklers.

S-14500. Belt Boxes. Fire occurred in a belt box of a woolen mill, near the picker room. Sprinkler in box promptly extinguished fire before it spread to the picker room, a danger which threatened.

Fire demonstrated the value of sprinklered belt boxes, even for small belts.

S-14248. Coat Closets. A fire occurred in a sole leather warehouse from a lighted pipe left in a workman's coat in a sprinklered clothes closet. The sprinkler in closet entirely extinguished fire.

Sprinklers should always be installed in coat closets.

S-14391. Sheathing. Fire occurred in a bobbin factory and was apparently extinguished by two sprinklers, but the fire got into the hollow wall space behind the wood sheathing. Wall had to be torn out from outside in order to extinguish the fire.

Hollow construction is a menace in any building and a handicap to efficient sprinkler protection.

S-14495. Water Shut Off. Fire occurred in the card room of a shoddy mill and was well under control by the sprinklers when the controlling valve was closed either by an employee or a member of the fire department. Fire then spread to other floors before it was extinguished by hose streams.

The closing of a sprinkler valve should never be authorized before an investigation is made to determine the extent of the fire.

Construction.

H-8681. Protected Steel Members. Fire occurred in a five-story garage of brick mill construction. The main girders were steel I beams on wooden columns on which the floor timbers rested. The girders were thoroughly covered with metal lath and plaster. They stood the test of fire and water, and showed no sign of stress of any kind.

H-8641. Unprotected Columns. Fire occurred on tenth floor of a tenant building of incombustible construction but with interior cast-iron columns entirely unprotected. Injury to building consisted chiefly in the buckling and crackling of the unprotected columns, allowing the roof to sag and bulging out the stair shaft partition.

The action of unprotected cast-iron columns exposed to fire is so well known that further evidence would not seem to be needed to prove that unprotected columns in old buildings should be protected. Had the fire occurred on a lower floor, the failure of the columns might have caused the collapse of the entire building.

Exposure.

H-8757. Shutters. A four-story brick building ten feet from newspaper printing building was seriously exposed by the fire. The chief ordered the shutters closed at once.

It was the general opinion that the shutters saved the building and averted a conflagration, as the waterworks gave out and the burning building was with difficulty held under control.

H-8707. Shutters. Fire occured in a large packing plant, destroying several buildings. Two buildings were saved, however, aided by the closing of the shutters. Owing to the fact that the management did not make a practice of closing the shutters at night, several shutters could not be closed at the time of fire because of obstructions.

It was fortunate that this did not prove fatal to the protection afforded by the shutters, and the moral is obvious.

Floor Openings.

H-8724. Floor Openings. Fire originated in the sub-basement of a five-story tenant manufacturing building of light construction. Stairs were open from sub-basement to first. Freight elevator from first through fifth floor was enclosed by light wood partition and wood traps, not automatic, broken in part and not closed at night. Fire spread up the stairway to first, thence it followed the freight elevator shaft to fourth and fifth floors, destroying the contents there.

The lack of proper enclosures around the stairway and freight elevator aided the rapid spread of fire to all floors before the arrival of the fire department.

H-8652. Floor Openings. Fire occurred on the sixth floor of a wholesale dry goods establishment. Automatic traps on stairs apparently closed promptly and confined fire to floor on which it originated.

Although this was a building of fire-resistive construction, the stairs were not cut off and the contents were combustible. The value of automatic traps, in lieu of more complete cut-off, was clearly demonstrated.

Supplies.

H-8513. Electric Pumps. A wharf storage property was protected by private hydrants which were supplied from a 150,000-gallon elevated tank. Two 500-gallon centrifugal electrically driven pumps were used for filling tank. About forty minutes after fire was discovered, the pumps were put out of commission by feed wires falling and current being cut out on these lines at power house to prevent injury to firemen.

All main feed wires for electrically driven pumps should be installed in conduit under ground; especially where they would otherwise extend over or near conflagration areas. Two separate and independent sources of supply for current should be provided.

Standard Rules and Requirements

PUBLISHED BY THE

National Board of Fire Underwriters

UPON RECOMMENDATION OF

THE NATIONAL FIRE PROTECTION ASSOCIATION

A copy of each revised edition of these pamphlets is mailed to members of the National Fire Protection Association on publication. Members desiring additional copies may obtain the same, without charge, by addressing the Secretary.

SUBJECTS.	Last edition.
Acetylene Gas Machines and Storage of Calcium Carbide	1908
Coal Gas Producers (pressure and suction systems)	1901
Electric Wiring and Apparatus (Nat'l Electrical Code)	1913
Electrical Fittings, List of Approved	April, 1913
Fire Departments, Private	1912
Fire Doors and Shutters	1908
Fire Hose, for fire department use	1912
Fire Hose, for private department mill yard use	1912
Fire Hose, Unlined Linen, for use inside buildings	1909
Fire Pumps (steam)	1911
Fire Pumps (electric)	1904
Fire Pumps (centrifugal)	1911
Fire Pumps (rotary)	1911
Gas and Gasolene Engines	1910
Gasolene Vapor Gas Lighting Machines, Lamps and Systems	1910
Gasolene Vapor Stoves, for cooking and heating	1903
Grain Dryers	1901
Gravity Tanks	1910
Hose Couplings and Hydrant Fittings, for public fire service	1911
Hose Houses, for mill yards	1905
Incubators and Brooders	1908
Kerosene Oil Pressure Systems	1902
Lightning, Protection Against	1907
Municipal Fire Alarm Systems	1911
Nitro-Cellulose Films (storage and handling)	1910
Oil Storage (fuel), storage and use of fuel oil and construction and installation of oil burning equipment	1902
Oil Storage (inflammable), systems for storing 250 gallons or less of fluids which at ordinary temperatures give off inflammable vapors	1904
Oxy-Acetylene Heating and Welding Apparatus	1910
Railway Car Houses (storage and operating), Construction and Protection of	1907
Signaling Systems, used for the transmission of signals affecting the fire hazard	1911
Skylights	1906
Sprinkler Equipments automatic and open systems	1910
Steam Pump Governors and Auxiliary Pumps	1908
Uniform Requirements (standard mill construction, "inferior" construction, general hazards, oil rooms, general protection, stairway and elevator closures, watchmen, thermostats, etc.)	1911
Valves, Indicator Posts and Hydrants, for mill yard use	1910
Waste Cans, Ash Cans, Refuse Barrels, Fire Pails and Safety Cans for Benzine and Gasolene	1903
Wired Glass and Metal Window Frame Construction	1906
Underwriters' Laboratories, general information in reference to the nature of its work and the terms and conditions under which tests of fire appliances and materials are conducted	1913

NOTE: **Special lists** of Fire Appliances, Devices and Materials, and Gas, Oil, Mechanical and Chemical Appliances, examined and tested by Underwriters' Laboratories, Inc., under the above standards and deemed suitable for use, are mailed to members semi-annually in January and July.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC.,

of *Quarterly: National Fire Protection Ass'n* published *Quarterly*
(Insert title of publication.) (State frequency of issue.)

at *Boston, Massachusetts,* required by the Act of August 24, 1912.
(Name of post office.)

NOTE.—This statement is to be made in duplicate, both copies to be delivered by the publisher to the postmaster, who will send one copy to the Third Assistant Postmaster General (Division of Classification), Washington, D. C., and retain the other in the files of the post office.

NAME OF—	POST-OFFICE ADDRESS.
Editor, *Franklin H. Wentworth,*	*87 Milk Street.*
Secretary-Treasurer.	
Publisher, *National Fire Protection Association.*	

Owners: (If a corporation, give names and addresses of stockholders holding 1 per cent or more of total amount of stock.)

Not incorporated.

For members only. *Scientific publication.*

No subscription price. *No advertising.*

Entered under act of July 16, 1894.

Known bondholders, mortgagees, and other security holders, holding 1 per cent or more of total amount of bonds, mortgagees, or other securities:

None.

(If additional space is needed, a sheet of paper may be attached to this form.)

Average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the six months preceding the date of this statement. (This information is required from daily newspapers only.)

Franklin H. Wentworth, Secretary-Treasurer.
(Signature of editor, publisher, business manager, or owner.)

Sworn to and subscribed before me this *seventh* day of *July,* 1913.

[SEAL.]

Fred'k J. Ranlett,
Notary Public.

Form 3526 5—6012

(My commission expires *Feb. 26,* 1920.)